Engineering
Library

JUN 17 1930

ELECTRICAL WORLD

JUNE 14, 1930

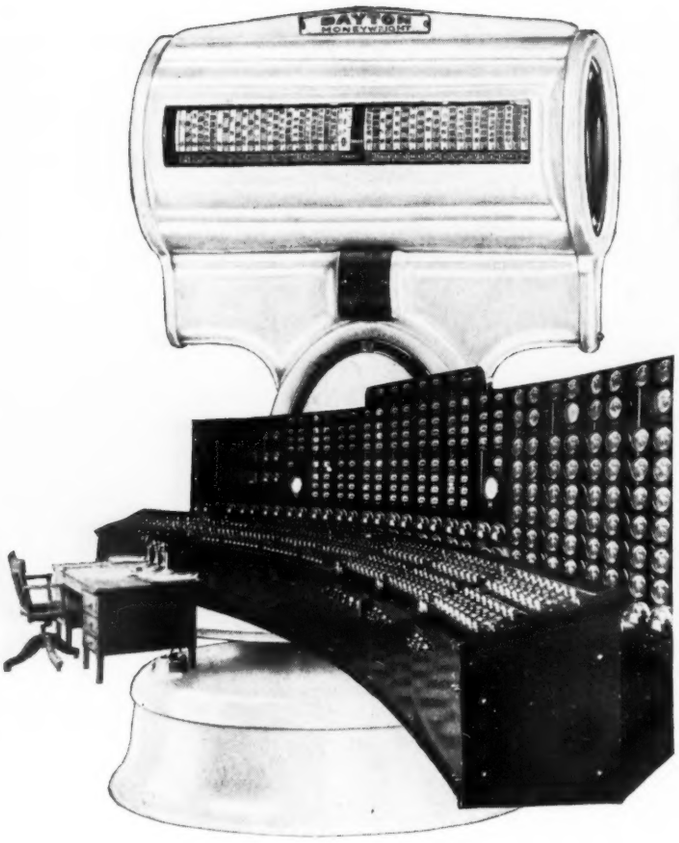
McGraw-Hill Publishing Company, Inc.

25 cents per copy

GIVE *Red Bands* YOUR HARD JOBS

HOWELL motors are easily distinguished by the Red Bands encircling the end frames and the easy way with which they master the hard jobs. This is true whatever the type, squirrel cage or slip ring polyphase; repulsion induction or brush-less single phase. Ask any Howell user.

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN



INSTRUMENTS
The Scales of the CENTRAL STATION INDUSTRY

THE modern chain store, trading on the narrowest margins of profit, must have the most dependable scales money can buy.

Nothing can be left to chance where hundreds of daily weight transactions mean either increments of profit or accumulations of losses.

The scales of the Central Station Industry are its electrical measuring instruments. No matter what the terminal applications may be or the number of consumers served, electric power is only one commodity to the engineer — measurable in volts, amperes and watts. But to the directors and stockholders it represents dollars and cents. Therefore, slightly higher initial cost of quality instruments is relatively unimportant.

Throughout the 42 years of Weston's history there have been no recurring periods of price-cutting. Price pressure has no more affected Weston's policy for upright dealing than unusual electrical stresses have affected the uncompromising accuracy of Weston measurements. The Weston price policy has been one of the greatest stabilizing factors in the electrical industry.

Weston has never penalized its reputation for highest quality by subscribing to the price-cutting evil in a buyer's market any more than it has penalized the purchaser by exacting an extra premium in a seller's market. Weston prices are based on the lowest margin of profit consistent with the maintenance of highest quality standards irrespective of market conditions.

The only pressure which Weston permits is the self-imposed pressure of pioneering developments to meet the increasing needs of industry with the most perfect instruments known to the world. It is this pressure, constantly applied over 42 years, which has contributed its share in accelerating the progress as well as the profits of the electrical industry.

Weston
PIONEERS SINCE 1888
INSTRUMENTS

WESTON ELECTRICAL INSTRUMENT CORPORATION
578 Frelinghuysen Avenue Newark, N. J.

ELECTRICAL WORLD

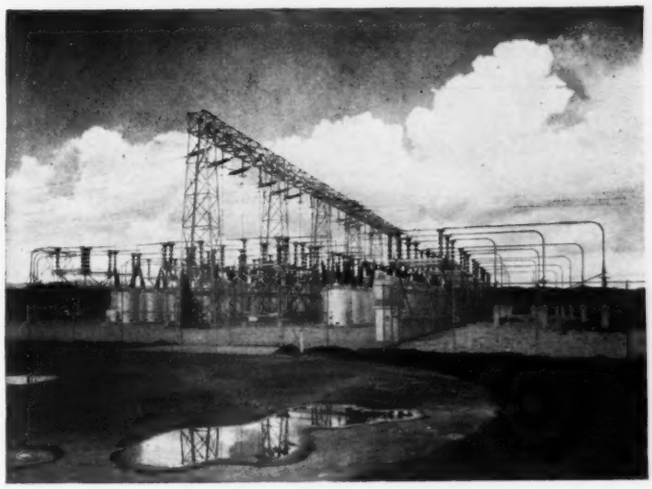
A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, *Editor*

ALLEN M. PERRY, *Managing Editor*
EARL WHITEHORNE, *Contributing Editor*
G. F. WITTIG, *Statistical Editor*
H. M. CAMERON, *Associate Editor*
A. E. KNOWLTON, *Associate Editor*
F. C. WELLS, *News Editor*
E. R. SEARLES, *Assistant Editor*

FRANK R. INNES, *Western Editor, 520 N. Michigan Ave., Chicago*
H. S. KNOWLTON, *New England Editor, 1427 Statler Bldg., Boston*
WALTER C. HESTON, *Pacific Coast Editor, 883 Mission St., San Francisco*
PAUL WOOTON, *Washington Correspondent, National Press Bldg., Washington*

JAMES H. RUDD, *Publishing Director*



JUNE 14, 1930

Contents Copyrighted, 1930, by McGraw-Hill Publishing Company, Inc.

VOLUME 95 . . . NUMBER 24

News of the Industry 1187

Wiring Flexibility Dominant in New Wiremold Plant 1200

What Insulation Values? 1207
By M. M. SAMUELS, *J. G. White Engineering Corporation.*

Record Customer Sales—Prospect for 1930 . . . 1209
By E. PAUL YOUNG, *President E. Paul Young Company.*

Cost Comparisons Decide Houston Network . . . 1211
By G. C. PLUMLEY and E. F. SEAMAN, *Houston Lighting & Power Company*

Half-Degree Temperature Control 1214
By W. B. KOUWENHOVEN and S. K. WALDORF, *Johns Hopkins University*

A Word for the Jobber 1219
By JOHN J. GIBSON, *Westinghouse Electric Supply Company*

Editorials 1197

Small Circuit Breakers Save Time Losses in Railroad Shop . 1206

Foresees Electronic Tube Replacing Many Existing Devices 1206

Recommended Color Scheme for Control Cable 1210

A Convenient Short-Circuiting Switch 1213

Improvised Post Hole Digger . 1217

Suggested Symbols for Power Apparatus 1218

Turbine and Generator Overhaul Reveals Peculiar Troubles 1220

No Longer "Light Companies" 1221

Electric Coal Handling Saves in Industrial Plant 1222

Seed Corn Testing Improved by Electric Heat 1222

Financial and Statistical 1227

New Equipment Available . . . 1234

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

JAMES H. MCGRAW, Chairman of the Board
MALCOLM MUIR, President
JAMES H. MCGRAW, JR., Vice-Pres. and Treas.
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
HAROLD W. MCGRAW, Vice-President
H. C. PARMELEE, Editorial Director
C. H. THOMPSON, Secretary

CABLE ADDRESS: "MACHINIST, N. Y."

Published weekly. $5 per year. 25 cents per copy. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Member A.B.C.
Member A.B.P.

NUMBER OF COPIES PRINTED THIS ISSUE, 18,500

NEW YORK District Office, 285 Madison Avenue
WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Avenue
PHILADELPHIA, 1600 Arch Street
CLEVELAND, 501 Guardian Building
ST. LOUIS, 1556 Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
BOSTON, 1427 Statler Building
GREENVILLE, S. C., 1301 Woodside Building
DETROIT, 2-257 General Motors Building
LOS ANGELES, 632 Chamber of Commerce Bldg.
LONDON, 6 Bouverie Street, London, E. C. 4

LIKE A DUCK'S BACK

OKONITE Twisted Service Cable is a hardy cable and stands all the weathering conditions to which this part of distribution plant is subjected.

It needs no laboratory tests, for its durability has been tested in many years of service on hundreds of thousands of installations.

The practical man will at once see the advantages of this cable over other kinds of service construction.

It is economical; not only in long life but in greatly reduced maintenance costs.

It is easy to install, minimizes attachments to customers' buildings, and the cable is neat and inconspicuous in appearance.

Okonite Twisted Service Cable is the logical thing to use for services because it affords these advantages and because the superior quality of its insulation and coverings gives it the stamina necessary for reliable performance.

Our booklet Twisted Service Cable and samples will be mailed upon request.

OKONITE PRODUCTS

Okonite Insulated Wires and Cables

Varnished Cambric Cables

Okonite Insulating Tape

Manson & Dundee Friction Tapes

Okocord

Okoloom

OKONITE-CALLENDER PRODUCTS

Impregnated Paper Cables

Super-tension Cables

Splicing Materials

THE OKONITE COMPANY

Founded 1878

THE OKONITE-CALLENDER CABLE COMPANY, INC.

Factories: Passaic, N. J. Paterson, N. J.

SALES OFFICES:

NEW YORK CHICAGO PITTSBURGH ST. LOUIS BOSTON ATLANTA
BIRMINGHAM SAN FRANCISCO LOS ANGELES SEATTLE DALLAS

Novelty Electric Co., Philadelphia, Pa.
F. D. Lawrence Electric Co., Cincinnati, O.

Canadian Representatives:
Engineering Materials, Limited, Montreal

Cuban Representatives:
Victor G. Mendoza Co., Havana

OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

ELECTRICAL WORLD

for the Week Ending

June 14, 1930

Amended power bill pleases Hoover

Niagara Hudson asks new set-ups

Interstate energy transmission 11.8%

$7,000,000 bid for Kansas City plant

—FOSHAY and National Power & Light properties are scheduled for next Federal Trade hearings. Brief time before closing of commission season precludes long-drawn-out investigations

—POWER COMMISSION agreement nears as Hoover lends encouragement to altered bills. Senate and House committees must get together now on revisions before any further action need be anticipated.

—KANSAS CITY, Kan., offered $7,000,000 for private plant. Apparently neither desire to sell nor legal authority to do so exists, but question is likely to be brought to voters.

—WESTINGHOUSE enters into patent licensing agreement with, and will acquire minority interest in, English Electric Company. Another step in international industrial progress.

—CENTRALIA permitted municipal hydro plant on Nisqually River. Unanimous decision of Supreme Court of Washington removes obstacles and presumably ends long fight.

—220-KV. LINE for West Coast will be built as result of previous field experience and laboratory tests, largely on corona action. Mountain, foothill, valley and coast sections to be separately designed.

—URUGUAY seriously considers favorable report of engineer for development of Rio Negro. Necessary enabling action foreseen as probable, while benefits to South America's richest little country are discussed.

—INTERSTATE ENERGY transmission increases to 11.8 per cent. Hydro shortage and industrial intensity of 1929 seen as responsible. Conowingo and State Line largest contributors.

NEWS OF THE WEEK

Power Commission Agreement Nears as Hoover Commends Bill

THE Couzens bill reorganizing the Federal Power Commission was approved by the House on June 9, despite opposition raised on the grounds that the measure would interfere with the work of the War Department on navigable streams. The bill will be discussed soon by conferees of the two Houses of Congress in order to reach a final agreement on terms. As passed by the Senate, provision was made for the administration of the act by three commissioners to be appointed by the President. The House interstate commerce committee increased the commission to five members.

President expresses gratification over progress on bill

Gratification over the progress toward replacing the Federal Power Commission with an independent body, instead of Cabinet members, was expressed by President Hoover on Tuesday. He is understood to have voiced the hope that the small differences between the Senate and House bills would be ironed out in conference.

Creation of an independent power commission, the President said, was a very important step because the work of the existing commission had become entirely too great for the three Cabinet members with their other duties to perform.

House altered Senate bill in several respects

Representative Parker of New York, chairman of the interstate commerce committee, explained to the House that the present bill does not seek to extend the regulatory powers of the government. He pointed out that only 5 per cent of the amount of power used in the country is of an interstate character and is unregulated by the various states. During the hearings on the bill by the interstate commerce committee it was agreed to leave out the section approved by the Senate prohibiting commissioners from engaging in any other business. This section was restored before the bill was passed by the House of Representatives.

The House committee also desired to put back into the bill a provision authorizing the new commission to engage a solicitor outside of the regulations of the civil service act. This part of the bill had previously been deleted. A point of order against this procedure to reinsert this language in the bill was sustained, however, and in its final shape the measure only authorizes the appointment of a secretary, a chief engineer, a general counsel and a chief accountant. All other persons employed by the commission will be subject to the Civil Service regulations unless the language of the Senate bill is adopted in the conference to adjust the differences.

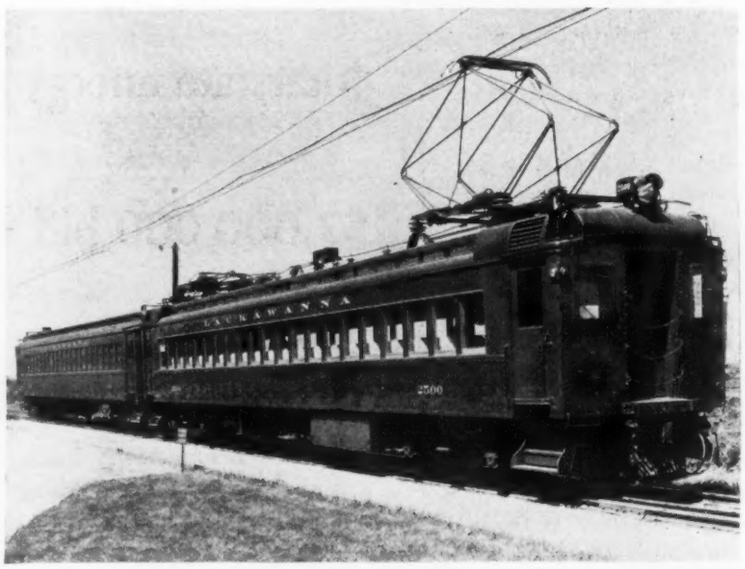
▼

Kansas City Startled by $7,000,000 Plant Bid

AN OFFER of $7,000,000 for the municipal light plant of Kansas City, Kan., by Nathan L. Jones, representing the Western Power, Light & Telephone Company, is furnishing much local discussion. Apparently there has been no recent agitation to indicate a desire for any change in supply arrange-

▼ ▼ ▼

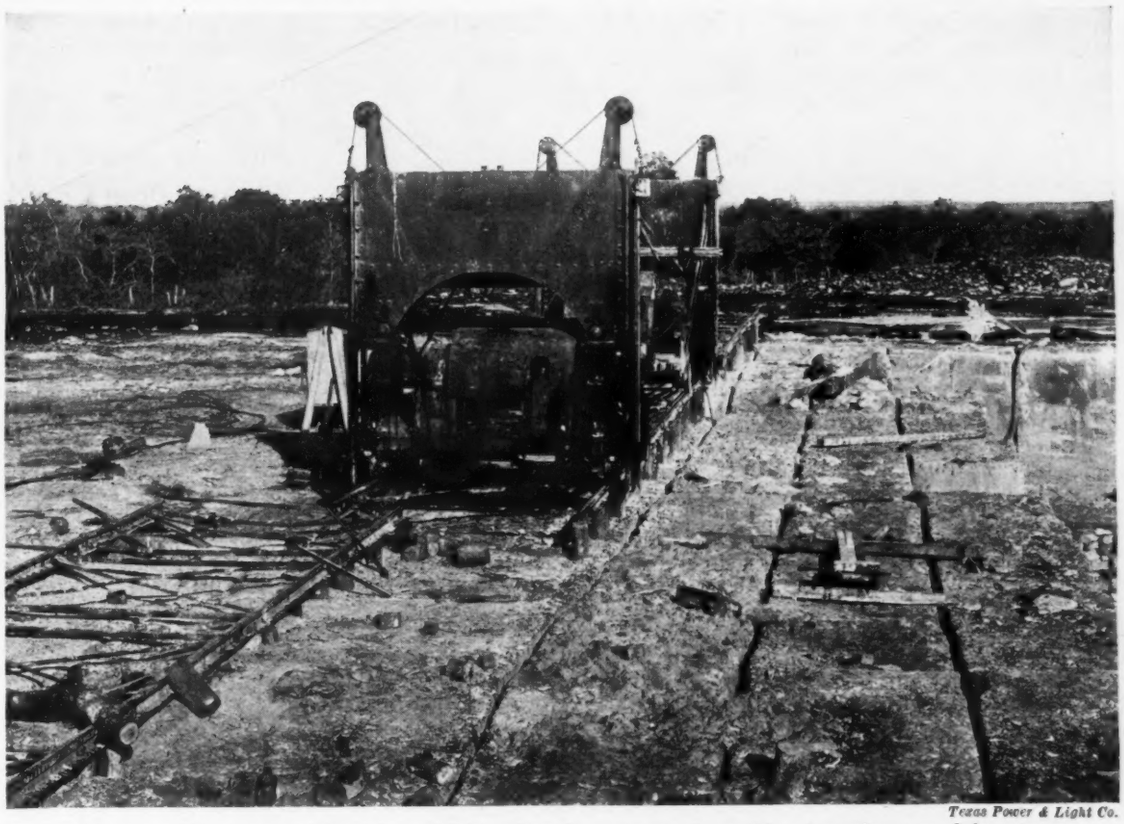
FIRST 3,000-VOLT D.C. MULTIPLE-UNIT CARS TESTED BY LACKAWANNA



Powered by 920-hp. motors, using the 3,000-volt direct-current system for the first time in multiple-unit service in America, this train attained a speed of 71½ miles per hour in recent tests. Equipped with electro-pneumatic brakes and traveling at 56 m.p.h., in emergency operation it was brought to a stop in two-tenths of a mile, without discomfort to the passengers. Such two-car units, each seating 166 people, will be used in trains of 2, 4, 6, 8 and 10 cars by the Lackawanna Railroad

(ELECTRICAL WORLD, *page 1065, May 31, 1930*)

LIMESTONE CUT AS THOUGH IT WERE ICE



Texas Power & Light Co.

Channeling machines, each driven by a 30-hp. electric motor and capable of cutting two 2-in. grooves or channels 10 ft. deep by 150 ft. in length every eighteen hours, are used in limestone production at the Austin, Tex., quarries of the Texas Quarries, Inc. The stone is cut in huge blocks, very much as natural ice is harvested, and prepared with fully electrified dressing and material-handling equipment

▼ ▼ ▼

ments on the part of the citizens of that city and no legal provisions are available for negotiating a sale. The proposal of Mr. Jones contemplates a general election to secure an indication of the wishes of the electorate.

Offer includes guarantees of rates and improvements

The proposal Mr. Jones submitted to the City Commissioners includes the following promises:

To pay $7,000,000 for the municipal light plant and system.

To deposit with the city treasurer $50,000 upon acquiring the property, to be held as surety that there will be no increase in present rates for five years.

To supply electricity for street lighting at cost and to supply electricity to the municipal water plant.

To build in the city an office building of at least eight or ten stories to house the personnel of the company.

To retain all of the present employees and employ a considerable number in addition.

To commence rehabilitation of the plant within twelve months of acquiring control, or start the building of a new plant.

To direct the activities of an entire new-business department toward the bringing to the city of industries.

To pay the entire cost of a special election to submit the question of sale of the plant to the voters and the granting of a franchise.

Legal opinions indicate necessity for action by state legislature before any sale could be made.

▼

Foshay and Bond & Share Properties Up for Hearing

FEDERAL Trade Commission investigatory hearings of power and gas utilities were scheduled for resumption on Thursday, with W. B. Foshay Company and Public Utilities Consolidated Corporation, both of Minneapolis, up for publicity. The commission's own examiners will be witnesses.

National Power & Light Company of the Electric Bond & Share Company group will probably be the subject of hearings to begin Monday, June 23. These meetings will, in all likelihood, be the last prior to the summer recess.

New York Consolidations Up to State Commission

SEVERAL plans for the elimination of intermediate holding companies of the Niagara Hudson system and the merging of operating properties are under advisement by the New York State Public Service Commission at the request of the power company.

Properties in the western part of the state could be consolidated under the name of Niagara Power Corporation, to be formed as a new operating subsidiary of Niagara Hudson Power Corporation. Companies involved in this step are: Buffalo, Niagara & Eastern Power Corporation, Lockport & Newfane Power & Water Supply Company, Buffalo General Electric Company, Niagara Electric Service Corporation, Niagara Falls Power Company, Niagara, Lockport & Ontario Power Company and Tonawanda Power Company.

In the eastern part of the state the operating properties of the Northeastern Power Corporation and Mohawk-Hudson Power Corporation, intermediate holding companies, are to become di-

rectly owned subsidiaries of the Niagara Hudson Power Corporation.

The contemplated transactions would eliminate three holding companies and create three principal operating companies. Hearings are scheduled for June 19 before the commission.

▼

Dill Patent Bill Killed After Senate Approval

THE Dill bill, aimed chiefly at the Radio Corporation of America and companies affiliated with it, but with possible far-reaching effects in other business fields, was passed by the Senate last week and recalled shortly thereafter.

Essentially, the bill would suspend the right of the patentee to recover, in suits for patent infringement, if the defendant can show that the patentee is violating the anti-trust acts. It is a matter of considerable importance in trades which depend largely on patents.

Announcement of Senator Walsh of Massachusetts that reconsideration would be made precludes House action, even in committee, during the current session and relegates it to the December session, where it will probably remain as open business.

Commonwealth & Southern Seeks Ohio Consolidation

AS A further move toward the simplification of its corporate structure, the Commonwealth & Southern Corporation has filed a petition with the Ohio Public Utilities Commission to consolidate the properties of the corporation in that state.

The companies involved are the Northern Ohio Power & Light Company, Ohio Edison Company, Akron Steam Heating Company, Pennsylvania-Ohio Power & Light Company and the London Light & Power Company. These companies operate public utilities in Ohio, furnishing light, steam heat and transportation services in Akron, Youngstown and Springfield and more than 125 other communities.

Under the agreement of consolidation, the electric and steam heating business of the companies will be united into one company to be named the Ohio Edison Company, which will assume all the bonds and other indebtedness of the constituent companies and will issue its prefered stock share for share of like dividend rate to present holders of preferred stock of the respective participating companies.

The new company also is seeking permission to acquire the Toronto power station of the Ohio River Edison Company and the transmission lines and substation equipment of the Ohio River Transmission Company.

▼

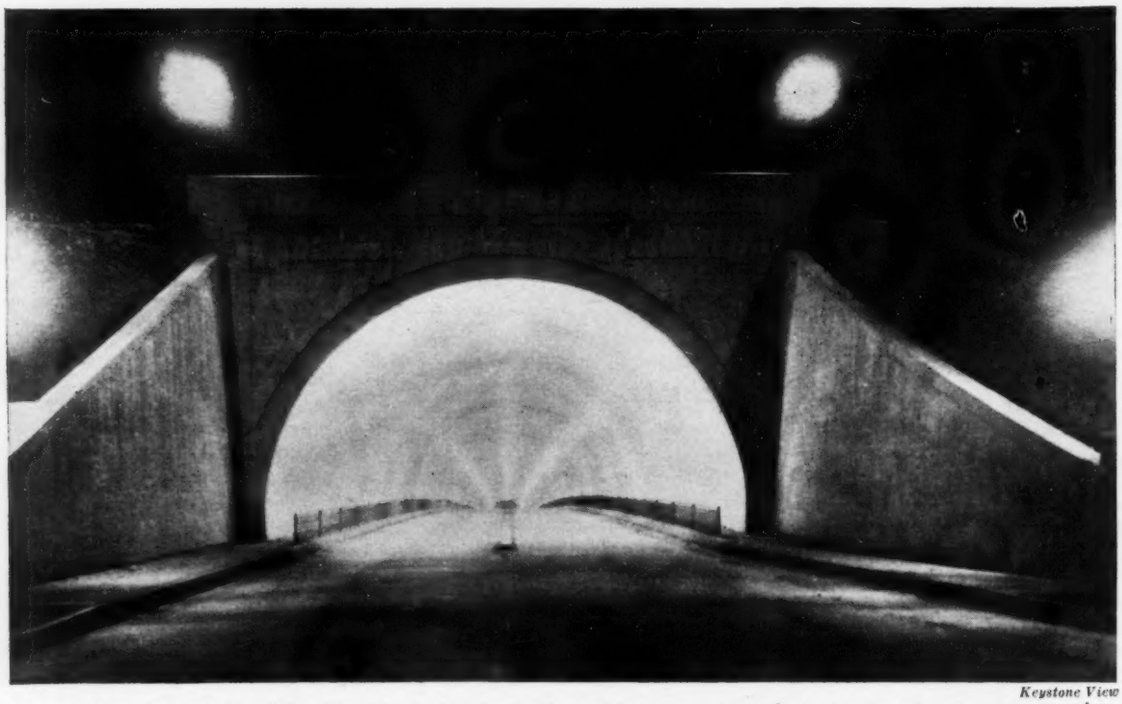
Attorney-General Approves Boulder Dam Contracts

APPROVAL of the power contracts whereby the Interior Department has underwritten the costs of the Boulder Dam project was handed down by the Department of Justice on Monday. The House committee on appropriations had been holding the second deficiency bill for this decision. Probably by the time this news account appears the bill will have been reported containing indorsement of the $10,660,000 required to start construction on the project. Early House and Senate passage can be expected.

In passing upon the contracts, Attorney-General W. D. Mitchell declared that they are valid and binding upon the parties and that they entirely satisfy the requirements of the Boulder Canyon act, standing as an express obligation to pay for electrical energy in definite quantities. He was inclined to minimize the objection that the Metropolitan Water District had not voted bonds to

▼ ▼ ▼

BRILLIANT LIGHTING FOR ASHEVILLE'S VEHICULAR TUNNEL



Keystone View

Beaucatcher Mountain, Asheville, N. C., has been pierced by a new tunnel to speed up local transportation. Lighting has been arranged to promote safe driving and the interior seems to be as bright by night as is the out of doors by day Perhaps the mountain will need a new name. This does not look much like a Lover's Lane

build the aqueduct for which the power would be used before signing for the electricity involved, since one step must precede the other. The contracts signed by the city of Los Angeles and the California Edison Company were judged to have fully satisfied the requirements of the act.

▼

Centralia Wins Decision for Municipal Plant

UNANIMOUS decision of the Supreme Court of the State of Washington has decreed that the city of Centralia may proceed with its hydro-electric power development project on the Nisqually River, dismissing the suit brought by H. M. Jones, Centralia taxpayer.

Following an election at which the voters approved a $650,000 bond issue to develop the project, the city commissioners spent $278,000. That election, however, was declared invalid by the Supreme Court because it had been irregularly advertised, and it was necessary to hold a second election, at which the bond issue was again approved by the voters. In his suit Mr. Jones contended that all contracts and disbursements made before the second election was held were illegal and that the voters could not make a void act valid.

Judge Walter B. Beals, who wrote the Supreme Court decision, agreed that the acts were invalid, but disagreed with Mr. Jones's theory that the voters could not validate the prior actions. The decision of the state Supreme Court upheld the former decision of the Lewis County Court.

The Nisqually plant, when completed, will have a capacity of 11,000 hp.

▼

N. E. L. A.—World Power Meetings to Link by Radio

THE most elaborate and widespread radio network ever assembled is being planned for June 18 to link the World Power Conference meeting in Berlin, Germany; the National Electric Light Association convention in San Francisco, Cal., and listeners throughout the world.

Five short-wave radio channels will span the ocean to carry the ceremony, which will begin at 4 o'clock, Eastern daylight saving time, and continue for 45 minutes.

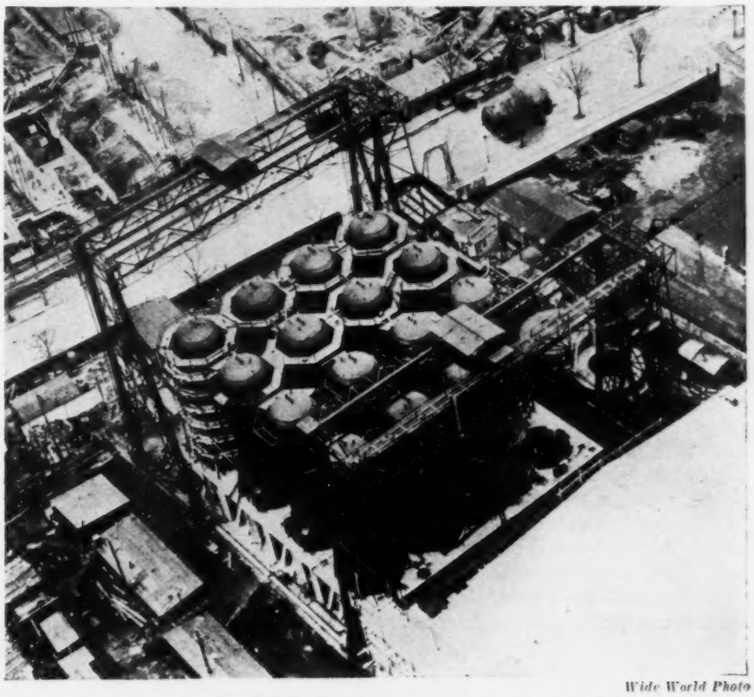
M. S. Sloan, president N.E.L.A. and New York Edison Company, will open the world-wide meeting from the rostrum of the San Francisco convention. Then the program will be switched to Berlin to pick up an address by Dr. Carl Koettgen, engineer and industrial leader; then to Camberley for Lord Derby; to Berlin again for an address by Dr. Oscar von Miller, president of the World Power Conference, then to London for Senatore Marconi's address. The point of pick-up will then be switched across the Atlantic Ocean to San Francisco to receive the talk by Mr. Young; then to the Edison Laboratories at Orange for the address by Mr. Edison.

Regulatory Group Formed by New England Men

THE New England Association of Public Utilities has been formed by members of the New England state utilities commissions. Henry C. Attwill of Massachusetts was elected president and Lewis Goldberg, Massachusetts, secretary.

▼ ▼ ▼

STEAM ACCUMULATORS CARRY BERLIN ELECTRIC PEAK LOADS



Wide World Photo

In order to carry the peak loads on the system of the Berlin Elektrizitätswerke A.G. without providing standard boiler equipment in excess of normal loads, these sixteen accumulators, with a standby capacity sufficient for 50,000 kw., are used. Fifteen are in place as shown; the final one to be installed is on the street

▼ ▼ ▼

Interstate Energy 11.8 per Cent in 1929

INTERSTATE transmission of electric power amounted to 10,856,000,000 kw.-hr. of the total of 91,656,000,000 kw.-hr. available for distribution to consumers during 1929, according to the statistical research department of the National Electric Light Association. The remainder, or 80,800,000,000 kw.-hr., was generated and consumed within the same state. These figures are exclusive of energy imported from Canada.

Of this relative increase in the proportion of interstate power, from 10.7 per cent of interstate electric power in 1928 to 11.8 per cent in 1929, about three-fourths is accounted for by two power plants, one the hydro-electric station at Conowingo, Maryland, and the other the new State Line, Indiana, steam plant. Much of the remaining relative increase is accounted for by temporary changes from the previous year caused by deficiency in rainfall in several parts of the country and by the abnormal industrial activity which characterized 1929.

The combination of abnormal industrial activity and the curtailed output from many hydro-electric plants due to lack of water supply resulted in increased demands upon steam-generating power stations. This increased the percentage of interstate power in some areas and decreased it in others, in some

instances even causing a reversal in the usual direction of the flow of power of interconnected systems.

▼

New 220-Kv., 114-Mile Line for West Coast

PACIFIC Gas & Electric Company has virtually completed specifications for conductors and supports for its new 114-mile, 220-kv., two-circuit transmission line between Tiger Creek and Newark. Corona tests in the laboratory have yielded important data influencing the decision.

Corona losses fully predetermined

Preliminary research on 700-ft. sections of three-phase lines using various types of conductors indicated that the condition of the surface of the conductors has a very marked effect upon corona loss. Weathering or oxidizing of the surface causes a very marked increase in corona loss at 220,000 volts, the ratio of loss between a new bright conductor and one that has aged a week or more being about 1 to 4. The presence of grease and dirt influences results also. Grease decreases corona loss, while dirt increases it. The tarnished surfaces which occur on conductors within a few days after being erected makes them more sensitive to atmospheric humidity. The size of strands and arrangement of the strands —that is, concentric vs. rope lay—has a pronounced effect. For equal surface conditions there seems to be no appreciable difference between copper and aluminum conductors of the same diameter.

Tiger Creek-Newark 220-Kv. Line

114 miles, two circuits.

Dead ends, single insulator string with extra strong units. Line will be completed in summer of 1931.

16 miles	**Mountain Section**—Single-circuit steel towers; 75 ft. between tower lines; 20-ft. horizontal conductor spacing; thirteen suspension units and corona shield; 518,000-circ.mil A.C.S.R., 1 in. diameter.
12 miles	**Foothill Section**—Double-circuit steel tower line; 28 ft. between circuits; middle arms project 5 ft. beyond upper and lower arms, 15 ft. apart vertically; same conductor and insulation as mountain section.
57 miles	**Valley Section** — Double-circuit steel towers, 28 ft. between circuits; 15-ft. vertical spacing; 500,000-circ.mil 1-in. hollow core copper conductor; insulation same as above.
29 miles	**Coast Section, Fog Belt**—Double-circuit steel towers; 33 ft. between circuits with 18-ft. vertical spacing; seventeen to twenty insulators with corona shield; 500,000-circ.mil 1-in. hollow core copper.

THE CROSSROADS OF THE WORLD

Wide World Photos

Always the Great White Way, but continually changing. This vista from Times Square shows Broadway and Seventh Avenue, New York, with the present crop of signs. The street lights appear rather lonely and somewhat dispirited in the riot of light

▼ ▼ ▼

Largest Substation for Boston's Tie Lines

CONSTRUCTION work is nearing completion on the new Woburn substation of the Edison Electric Illuminating Company of Boston. The building, of concrete on steel with brick facing, measures 222 ft. long by 50 ft. wide and will be the largest substation on the entire Edison system, constituting the main transmission junction for the company's territory north of Boston. Power will be taken from the hydro-electric development on the Connecticut River in northern New Hampshire, 145 miles northwest of Boston.

To meet the New England Power Company's 110,000-volt system at Tewksbury, two single-circuit transmission lines have been installed on steel towers over a private right-of-way from the new station, a distance of 13 miles. Each of the two transmission lines between Tewksbury and Woburn is capable of transmitting the entire demand the Edison company will take from the water-power development, so that the supply is assured even with the loss of one of the lines.

In the rear of the new station an initial installation of two 25,000-kw. transformers has been made which will serve to stepdown the transmission voltage to 13,800, at which voltage the power will enter the substation. Special fans permit an increase in rating of 50 per cent.

▼

Development of Rio Negro in Uruguay Is Probable

REPORTS from Montevideo, Uruguay, state that the government of that country is virtually determined upon the hydro-electric development of the Rio Negro. Favorable action is foreseen following the official survey conducted at the request of the Comision de Tecnicos by a German engineer, A. Ludin.

The Rio Negro traverses the republic from east to west, having its source in Brazil, and flows into the Rio Uruguay, a tributary of the La Plata system.

"The utilization of a source of hydro-electric energy so important and bountiful cannot fail to be a boon to a country lacking in ample deposits of fuels," Professor Ludin's report states. "The hydro-electric utilization of the Rio

Negro will not only be feasible in both a technical and an economic sense, but its prompt realization is dictated by the social needs of the country."

This favorable finding is looked upon in Uruguay as insuring the start of this undertaking, which will rank among the major hydro-electric projects thus far instituted in South America. Vast areas devoted now to cattle and sheep raising and cereals are foreseen as opened up to a much more diversified industrial program. Electric lighting and power costs and conditions in and about Montevideo are viewed as greatly affected.

▼

Industrial to Add 140,000 Hp. for Generation

WHEN construction projects now under way in the United States are completed Union Carbide & Carbon Corporation will have available for its various subsidiaries 140,000 hp. in addition to its present resources. Another 60,000 hp. will be made available in Norway. This company's subsidiaries now use about 250,000 hp. in manufacturing operations, not including the power required for driving machinery or illumination. Of that amount 100,000 hp. is supplied by the company's own plants and 150,000 hp. on contracts with utility companies.

Present plans, which have been approved by the directors, call for the expenditure of about $15,000,000 or $16,000,000 of the $53,000,000 total new funds. Appropriations already have been made for an important addition to the metallurgical plant in West Virginia.

Hydro and steam plants to be built

Contracts have been let for the power development at Hawks Nest on the New River in West Virginia. This project will develop an average of about 80,000 hp.

A new steam power plant, which will develop about 60,000 hp., also is being erected in West Virginia adjacent to a large coal mine which Union Carbide recently bought.

▼

5,600 Complete Courses of New York Companies

LAST week was graduation time for more than 5,600 employees who have completed one or more of the educational courses conducted by the New York Edison Company and the Brooklyn Edison Company. Diplomas and certificates for this year's graduation exercises exceeded 7,700.

The diplomas, which represent the successful completion of a specified group of five courses in either technical or commercial subjects, covering several years of study and instruction, numbered 129. Certificates are awarded for the completion of single courses.

▼

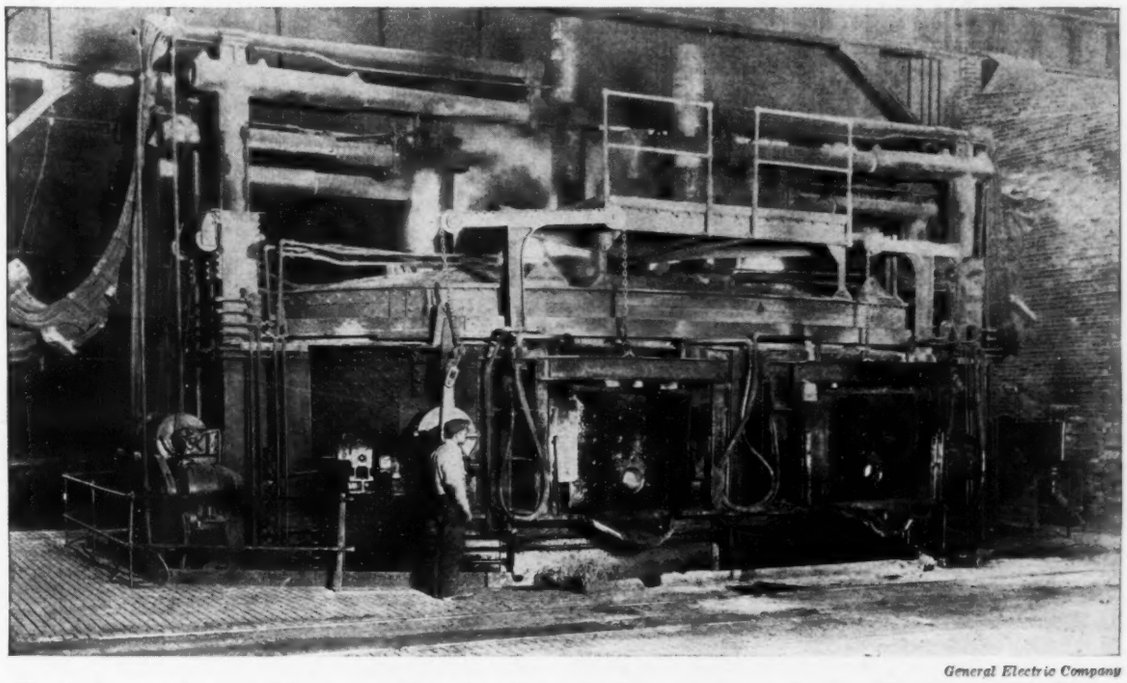
N.E.L.A. Detects an Error in Alleged Write-ups

SUPPOSED misinterpretation of information emanating from Washington regarding the Federal Trade Commission has led Paul S. Clapp, managing director of the National Electric Light Association, to call attention to a note prefacing the reports of the commission's examiners which says, in part, that the report "does not purport to go into questions of the fair value of the property of these public utilities (operating companies) or fair rate of return or reasonable rates for services rendered, and the Senate resolution in question did not call for such information, which would have required, among other things, an appraisal of all the properties of the utilities in question."

"It would appear from the above," Mr. Clapp points out, "that the Federal Trade Commission examiners have not sought to compare the stated ledger value of the assets of these companies, or the liabilities outstanding against the same, with the actual value of the properties."

▼ ▼ ▼

ELECTRIC STEEL NO LONGER LIMITED TO SPECIAL HEATS



General Electric Company

Slowly but surely electricity is usurping the place of other energy and heat applications. This 80-ton, three-phase arc furnace in the Canton, Ohio, plant of the Timken Roller Bearing Company is used in the manufacture of alloy steel. Two sets of electrodes are each supplied by a 10,000-kva. transformer.

Oregon Developments Mix Water Power and Politics

THE Oregon Municipal Ownership League has filed with the State Engineer an application for 50,000 sec.-ft. of water from the Columbia River for the developing of hydro-electric power, advising the state that "our application is merely to have available for the city of Portland and the state in the future years rights to develop the tremendous hydro-electric resources for public ownership."

Oregon's Democratic nominee for Governor, Edward F. Bailey, has formally announced that he will strongly oppose any movement calculated to encourage state development of hydro-electric power along the Columbia River. Mr. Bailey contends that such an undertaking would result in bankruptcy for the State of Oregon or, at least, the burden of the proposed projects would reflect in the taxes of the commonwealth for countless years to come, and that the development of the Columbia should be left to the United States government. George W. Joseph, Republican choice for Governor, advocates public ownership and development of the Columbia River resources, and recommends that certificates of indebtedness be issued by the state to finance the hydro-electric power projects.

Ballot petitions may be omitted in fall elections

The Oregon State Grange initiative petition providing for constitutional amendments which will authorize municipalities and counties to incur indebtedness for the purchase, construction and operation of electric utilities may be left off the next November ballot due to court delays in deciding the validity of the measure's ballot title. The case is now in the hands of the Supreme Court.

Due to the absence of a $3,000 fund to cover the cost of securing the necessary number of signatures, the initiative petition providing for the repeal of the public service commission laws may not appear on the November ballot.

Illinois River again sought for power development

Whether or not the Oregon Reclamation Commission is authorized under the revised water code of the state to grant permits for five hydro-electric power plants on the Rogue River will be determined by the Attorney-General.

Applicants propose to utilize the Illinois River by canals to a point on the Rogue River where five power units developing 200,000 hp. will be established. Under the water code act of the 1929 Legislature Rogue River is closed to appropriation for all purposes other than irrigation and domestic uses and provision of the code extends also to the prohibition of dam construction in the stream. It is contended, however, that as the applications were filed prior to the enactment of the 1929 laws subsequent legislation does not apply.

▼

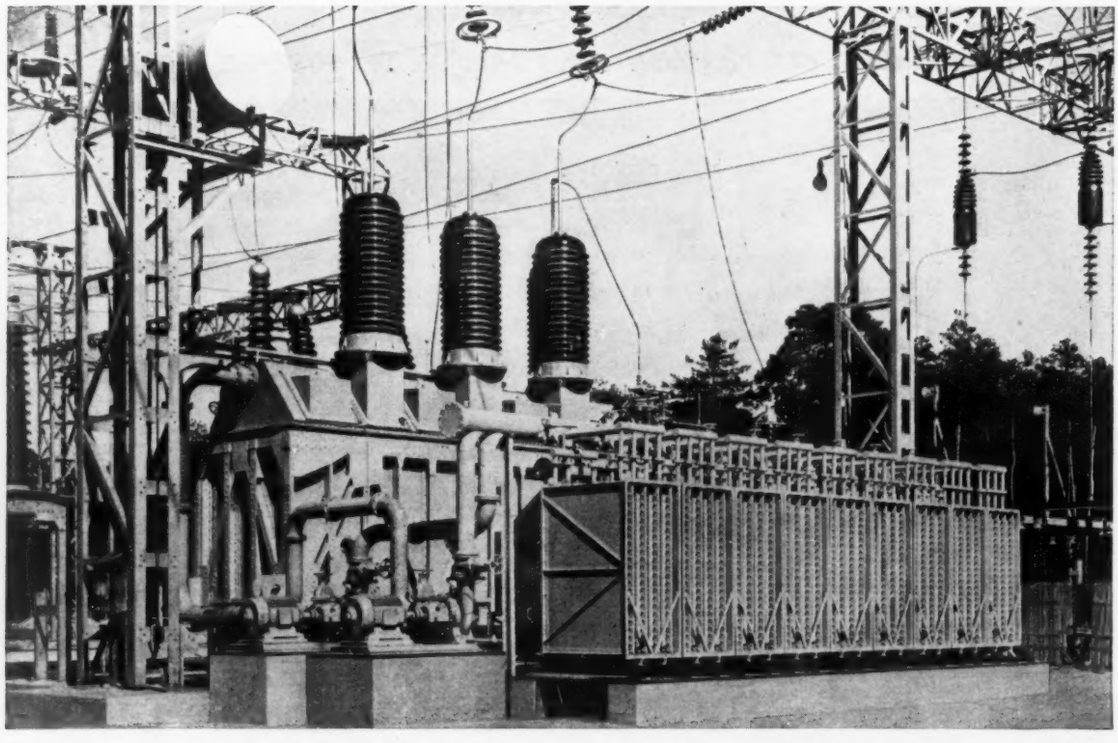
Rochester's Fountain Has 79 Kw. and 15,000 G.p.M.

ELECTRICAL illumination of Cobb's Hill fountain, Rochester, N. Y., installed last year as a part of the Light's Golden Jubilee celebration, will again be furnished this summer by the Rochester Gas & Electric Corporation. Twenty-four new lamps have been added to the display for this year. The total load is 79,000 watts.

The illumination will show the spray of the fountain in a radius of 15 miles as it rises from the reservoir to the height of from 50 to 60 ft. The flow of water averages 15,000 gal. a minute, supposedly constituting one of the greatest volumes of rising water ever subjected to electrical display.

▼ ▼ ▼

OUTDOOR TRANSFORMERS AS GERMANY BUILDS THEM



One of fourteen 220/110/55/10-kv. oil-cooled transformers recently installed by the Rhenish-Westphalian Electric Power Company of Essen, Germany. This 60,000-kva. unit utilizes a 10-hp. motor to supply air under ½-lb. gage pressure to the nine cooling elements. Two centrifugal pumps capable of delivering 990 gal. per minute circulate the oil between the transformers and coolers

Coming Meetings

Pacific Coast Division, N.E.L.A.—San Francisco, June 16. S. H. Taylor, 447 Sutter St., San Francisco.

National Electric Light Association—San Francisco, June 16-20. A. J. Marshall, 420 Lexington Avenue, New York.

Association of Iron and Steel Electrical Engineers—Broadway Auditorium, Buffalo, N. Y., June 16-20. John F. Kelly, Empire Building, Pittsburgh, Pa.

World Power Conference—Berlin, Germany, June 16-25. O. C. Merrill, Edmonds Building, Washington, D. C.

Wisconsin Utilities Association—Accounting Section, Eau Claire, June 19 and 20; Electric Section, Lorain Hotel, Madison, July 17 and 18. Commercial Section, Green Bay, July 31 and August 1. J. N. Cadby, 105 Wells St., Milwaukee.

American Electric Railway Association—San Francisco, June 21-26. Guy C. Hecker, 292 Madison Ave., New York.

American Institute of Electrical Engineers—Summer convention, Toronto, June 23-27; Pacific Coast Convention, Portland, Ore., Sept. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Haddon Hall, Atlantic City, N. J., June 23-27. C. L. Warwick, 1315 Spruce St., Philadelphia.

Camp Co-operation X—Association Island, Henderson Harbor, N. Y. July 31-August 4. Society for Electrical Development, 420 Lexington Ave., New York.

Association of Electragists International—Hotel Schroeder, Milwaukee, August 18-20. L. W. Davis, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Northwest Section, Bellingham, Wash., Aug. 25-27. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore.; Western Section, Congress Hotel, Chicago, Ill., Sept. 15-18. W. S. Boyd, 175 Jackson Blvd., Chicago, Ill.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 3-5. Harold A. Buch, Telegraph Bldg., Harrisburg, Pa.

American Railway Association—Hot Springs, Ark., Sept. 9-11. H. S. Balliet, 30 Vesey St., New York.

Empire State Gas & Electric Association—Annual meeting, Saranac Inn, N. Y., Sept. 18 and 19. C. H. B. Chapin, Grand Central Terminal, New York.

Eastern Association of Electrical Inspectors—Annual meeting, Pittsfield, Mass., Sept. 22-24. R. Walker, 85 John Street, New York.

Great Lakes Division, N.E.L.A.—Annual convention, French Lick Springs, Ind., Sept. 25-27. T. C. Polk, 20 North Wacker Drive, Chicago, Ill.

New England Division, N.E.L.A.—Annual convention, New Ocean House, Swampscott, Mass., Sept. 29-Oct. 1. Miss O. A. Bursiel, 20 Providence Street, Boston, Mass.

▼

Cincinnati Cable Job to Be 3-Conductor, 66 Kv.

UNION Gas & Electric Company, Cincinnati, Ohio, will replace four overhead 66-kv. circuits between the transformers at its Columbia Park generating station and its terminal transmission lines with three-conductor cable of like capacity. This, it is said, will be the first such installation in this country. Oil-filled armored cable, fabricated by the General Electric Company, will be shipped and installed in five lengths, each approximately 1,300 ft. long. Four of the cables are to carry load (37,500 kva. each) at one time; the other cable will be a spare. Thirty-two oil-filled terminals and twelve feeding type oil reservoirs will be used with the installation.

SHREVEPORT BUILDS FOR COMMUNITY GOOD WILL

An exemplary lesson in attractive yet not expensive design. This building, recently placed in operation, serves the Southwestern Gas & Electric Company both as a transformer substation and as an indication of good neighborliness. It is located in a residential community

▼ ▼ ▼

▼

Municipal Account Check Planned in Indiana

CHARGING that municipally owned utilities, particularly electric and gas services, have been escaping check-up of their accounts, either by his department or the Indiana Public Service Commission, Lawrence F. Orr, chief examiner of the Indiana State Board of Accounts, has indicated that he will remedy the situation at once.

Appointment of two field men to specialize in checking the books of the municipal plants of the state was announced. Another team which will do nothing but this sort of work will be appointed later.

"In the past the only check-up we have had of municipal utility accounts has been their reports to their city governments," Orr explained. "The Public Service Commission has audits made only in rate cases. Consequently the inner operations of these plants has remained something of a mystery. Reports have reached us that this sort of investigation is needed sorely in some instances."

Middle West Survey Favors Small Farms

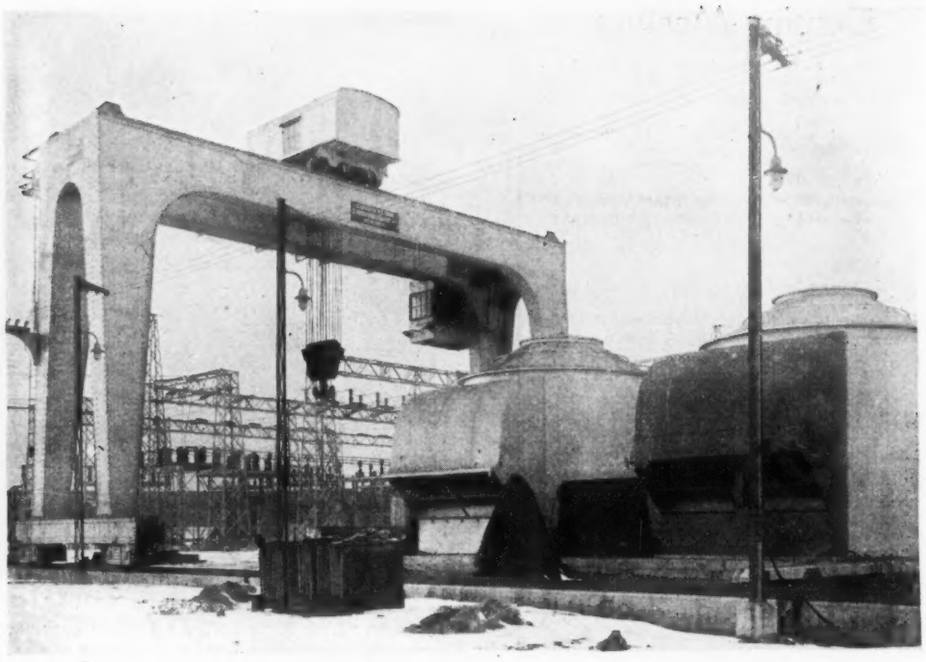
PREDICTING that 1,000,000 farms in the United States will receive electrical service within the next four years, a survey recently made by the Middle West Utilities Company attacks the theory that the farmer's problem would be greatly reduced if small farms were grouped into large ones.

"Because electric power is divisible and possesses the distinctive ability to reach small and scattered operations, users of small amounts of power can command as efficient a power supply as users of large quantities," it is stated. "In the application of electric power to agriculture this is greatly to the advantage of the family-unit size of farm.

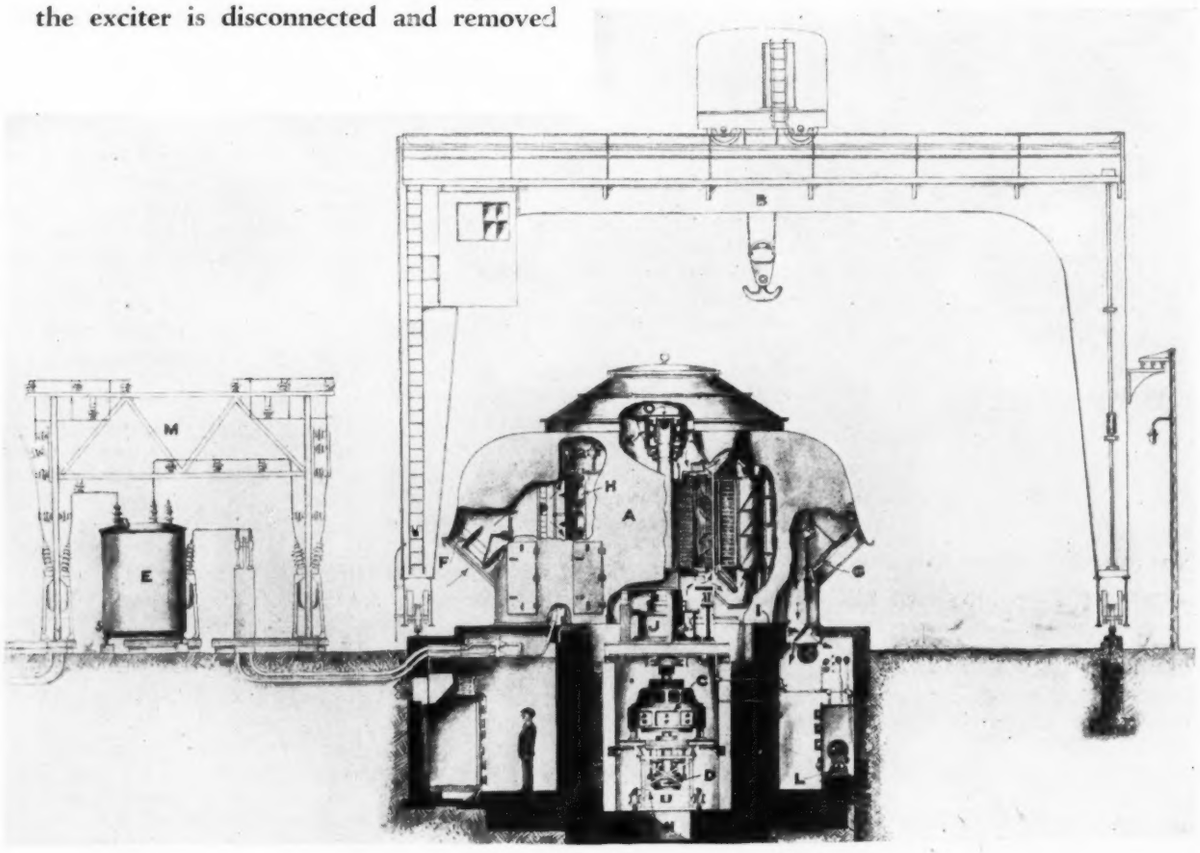
"Because of the scattered jobs to be done and the kind of power available for and fitted to such jobs, the farm power plant of 50,000,000 hp. aggregate capacity, despite its enormous aggregate, still requires nearly two man-hours of labor for every horsepower-hour of work delivered by its vast multitude of animals and machines. On our farms every year about 30,000,000,000 man-hours of work are required for every 16,000,000,000 hp.-hours delivered by animals and mechanisms. At the lowest estimate the work of women in the farmhouse totals another 15,000,000,000 'woman-hours.'"

It is concluded that the small farm stands to benefit particularly from the application of electricity to agriculture and that the family-unit farm is likely to persist instead of being replaced to any great extent by larger ones.

Another Outdoor Installation



EASE of maintenance and minimum exposure to weather are features of the two outdoor 25,000-kva. synchronous condensers at Leaside substation of the Hydro-Electric Commission of Ontario. If the stator has to be repaired, the exciter is disconnected and removed on truck *N*, and the blocking under bearing *J* taken out so the rotor can be lowered by the crane. Incoming air is screened and the housing is lagged to prevent condensation.



EDITORIALS

L.W.W.MORROW
Editor

To the Engineer Graduates—Avoid Complacency

IN A short time the intellectual atmosphere will be suffused with paternal advice from the alma maters' male mentors to the graduating engineers. They call them baccalaureates, and to be permitted to deliver one is a privilege we all have coveted. For fear, therefore, that an amateurish effort would be eclipsed by the masterly admonitions of late June this one is released now.

Addressing the student of power engineering, it is reasonably safe to assume that he has acquired an excellent picture of power systems as they have been evolved by accretion from sound principles of physics and abstract engineering. The great risk is that he has been so imbued with the romance and the propriety and concordance of the practices built on these principles that he is much too prone to accept each of them as finality itself. But that degree of complacency, flavored only with a zeal to devise improvements here and there, is the mark of the mediocre engineer.

It is only the mediocre engineer who believes system interruptions are inevitable, that frequent outage of apparatus for overhauling is equally unavoidable, that today's circuit breakers are the last word in handling obstreperous energy, that system faults cannot be localized as readily as a leak in a water main, that cables must forever have less carrying capacity than their conductors, unhampered by thermally restrictive insulation. The engineer who aspires to eminence will look at all these obstacles to better and cheaper power service in their comprehensive aspect, unwilling to accept them as of divine origin, eager to demonstrate that the best of the pioneers can be outdone by revolutionary advances. Here enters the virtue of educational emphasis upon fundamentals, because the most successful engineer will be the one who can rationalize afresh from these first principles and point the way to the radical developments on which the forward march of unleashed power will depend.

Seven-Tenths Pound per Kilowatt-Hour

THE mercury-vapor generating unit at the South Meadow station of the Hartford Electric Light Company is producing a net kilowatt-hour upon a fuel consumption of seven-tenths of a pound, or approximately 10,000 B.t.u. in regular daily service, according to a recent announcement by President Samuel Ferguson. Comprehensive tests of this unit by Stone & Webster and the General Electric Company are now being analyzed and will be made public in the near future, together with an official statement by Vice-President T. H. Soren of the Hartford company as to the economy and reliability of the mercury-vapor process in commercial central-station service.

News of this achievement is spreading swiftly through power engineering circles; the record-breaking figure above cited is arousing even the more skeptical prime mover and plant designers to study the process seriously, and competition to take advantage of this development is already in sight. Every passing week since February 4 has furnished cumulative evidence that a tremendous forward step has been taken in the application of the process evolved by Mr. Emmet and his associates to heavy-duty power production. The engineering profession awaits with keenest interest

the release of further particulars of this splendid triumph over obstacles which at times threatened to throw the entire development into the discard as a commercial practicality. We leave our readers to ponder upon the significance of seven-tenths of a pound of coal per net kilowatt-hour to the electrical industry.

Control of Conditions in Research

THE convenient method of independent automatic temperature control for several experimental oil cells, described elsewhere in this issue, is interesting in itself, but perhaps more so for the light that it throws on the difficulties attendant upon careful experimental research on the properties of insulating materials for high voltage. Increasing demands for greater carrying capacities, and so higher voltage, in underground cables are bringing forward more and more prominently the importance of the question of the nature and causes of dielectric loss and other properties of impregnated paper.

The combination of a refined type of cellulose with an oil found in nature, and also carefully refined, forms a really remarkable insulating material. It combines in amazing degree the requisite electrical and mechanical properties for a conductor which must be prepared in its final insulated form in the factory, coiled for transportation, and withstand the trying ordeal of installation and operation within the narrow confines of the usual underground duct. That we now have available underground cables operating at voltages approximating the highest values obtaining on overhead lines is a fine tribute to the ingenuity, skill and courage of the large number of research and manufacturers' engineers whose contributions make up the sum total of our present knowledge.

Both paper and oil are extremely sensitive, as regards electrical properties and life, to the presence of either air or moisture, or indeed other contaminating substances, even in the smallest quantities. Experiments indicate that with increasing temperature, paper will continue to give up moisture after its mechanical structure has been completely destroyed. Similarly the influence of small amounts of moisture and air on the dielectric strength, the power factor and the life of oils has long been recognized. On the other hand, the quantitative relations obtaining on these questions, as related to the chemical and physical structure of the paper and the oil, are still questions to which even approximate answers are not yet available. And beyond this is still the question of the behavior of the respective materials when brought together.

Electron Tubes as Substitutes for Relays and Regulators?

IF ELECTRON tubes are mentioned to most engineers in the industrial or electric light and power field they may become interested if they have succumbed to the radio-fan epidemic, but usually they appear listless or indifferent. They still conceive of electron tubes as being useful only in the communication field and entirely outside their everyday problems, except possibly for lighting control, carrier-current dispatching or possibly automatic counting.

But electron tubes have been developed for so many purposes that might be adapted to requirements in the power field that electrical engineers may suddenly find themselves forced to assimilate an entirely new phase of science if they do not follow developments in their formative stage. Particularly is this true of engineers who must busy themselves with applications of relays, although modifications and extension of electron-tube principles may bring them into other power applications.

Is the electric power industry going to wait for the electronic engineer to visualize the applications of electron tubes in the power field and then run the chance of failing to recognize the value of his suggestions, or is he going to study what has been developed and with his knowledge of power requirements suggest how electron tubes can be applied to his needs?

Right now seems none to early for power engineers individually and collectively to analyze all the various requirements for relays and determine

which may be met better by electron tubes. Then, too, there are many mechanical regulating devices the functions of which may better be served by electron tubes. The lack of inertia in electron tubes, the absence of contacts, the small currents required to actuate them, and consequently the smaller control circuits necessary, may make them particularly suitable for some applications. But possibilities of substitution should not be the only phase studied. New applications may be found if the characteristics of electron tubes are analyzed. Later may come electron-tube circuit breakers, converters and frequency changers.

Why Not Trap the Flicker?

THE user of illumination can be forgiven for vexatiously characterizing steadiness of illumination as a more significant aspect of illumination quality than glare or poor distribution. These defects, if present, are constant and make less dent on the consciousness than an annoyingly repetitive defect like flicker. This psychology is recognized and enters the discussion now taking place about less restrictive allowances for motor-starting currents. Generosity in this direction to promote motor and appliance loads soon runs afoul of lamp flicker, however.

Recently these columns suggested the possibility of discovering a lamp filament material having all the attributes of tungsten, but surpassing it in presenting more mass and thermal capacity to tide over the flicker period. Another possibility is the instantaneously responsive regulator, not for the feeder, but for the individual transformer and even the individual service entrance. Naturally it must avoid the complexity of the induction feeder regulator and equal the simplicity of the transformer itself. It does seem as if some inexpensive static device should soon appear with the capability of almost anticipating the dip in voltage. Such a device at every point where flicker provokes complaint would greatly promote the acquisition of motor loads and heating loads, enlarge the freedom of motor design and reduce to lowest terms the problem of distribution regulation.

Bottlenecks in Industrial Plants

WHEN the energy supply for a new industrial plant is considered, the owners generally insist on two or more sources of supply. This request is sometimes justified by load and rate conditions, but sometimes it is quite unfair.

The utility generally goes to a great deal of trouble to provide such a multiplicity of energy sources, providing expensive breakers and other equipment for each circuit at the factory end. Then the factory owners proceed to combine these various sources on one bus without any possibility of separating them—*bottleneck No. 1.* A separate circuit is then run to each transformer, each circuit again equipped with expensive breakers and even bypasses, a multiplicity of single-phase transformers is provided, spare transformers are added, disconnects are provided in the transformers to disconnect a single-phase unit quickly, but no breakers are installed on the low side and no differential protection, so that a failure of one transformer will shut down the whole plant—*bottleneck No. 2.* Then a single low-tension bus is provided—*bottleneck No. 3.* Then one connection is run from the bus through the meters to the feeder system—*bottleneck No. 4.* Then, again, a multiplicity of spare switches and bypasses, and again one feed to an important group of equipment—*bottleneck No. 5.* And so on *ad infinitum,* a multiplicity of spares, all feeding through some bottleneck.

Why all these bottlenecks on installations where the expense is not the primary factor? Why a single bus when the cost of one single breaker is more than the cost of a second bus with transfer disconnects in each circuit? The argument that a bus failure is very infrequent is weak, because so are transformer failures and breaker failures infrequent. Yet spares are provided at much greater expense than that of a second bus.

Sometimes it is a traditional desire to get along with one meter, sometimes it is the advice of a zealous power salesman who neglects to consult his own engineering department, sometimes it is the advice of an equipment salesman who neglects to consult his own station design department; but most often it is the fact that very few engineers visualize complete installations and bottlenecks.

Wiring Flexibility Dominant in New

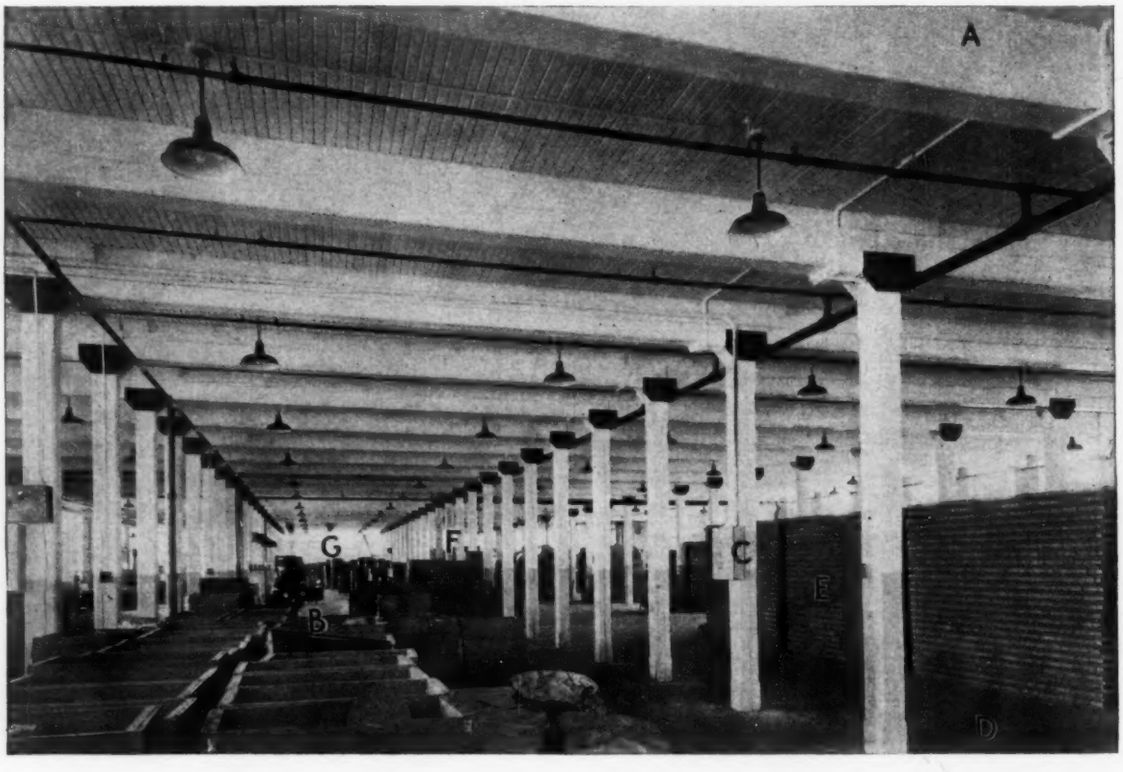
WHENEVER an electrical manufacturer builds a new factory one of the most important considerations is the extent to which his own product should be utilized in the establishment. If he installs his product on the basis of an engineering study of its adaptability to his own situation he proceeds along lines certain to reveal its fitness for service much more effectively than where such an application is primarily the result of commercial bias. A well-planned layout of home products is always useful from the exhibition standpoint, but to the industrial electrical engineering visitor the most significant point of interest in such a plant is how well the product meets the local requirements in the face of competition with other methods and material which would naturally be considered in the construction of a new establishment or the moderniza tion of an old factory.

Recently the Wiremold Company completed the first unit of a new factory at Hartford, Conn., designed to achieve economical production on the basis of carefully controlled investment outlay and the utilization of the most modern electrical methods within reach of the management. These included a survey of the plant's needs from the wiring standpoint, the provision of flexible high-grade lighting and the installation of motor-driven machinery under conditions which would insure flexibility of service during the transition period in which the company would be operating prior to complete concentration of production in one establishment, as well as later. Plans for the electrical layout were prepared by Paul D. Bemis, consulting engineer, Hartford, and the Hartford Electric Light Company's illuminating

▼

Daylight is less effective than artificial lighting here

At the left is a departmental view taken by sunlight and at the right a picture of the same area taken at night without the aid of accessory flash or spot lighting. Neither photograph has been retouched. The improved distribution secured by man-made illumination is emphasized by comparing B′ with B; C′ with C (better detail at night at the lighting cabinet); D′ with D (more shadows in the day time); E′ with E (details of stacked stock show up more effectively at night); F′ with F (the cases appear to more advantage after dark); and G′ with G (the distant end of the shop is brought out clearer by artificial light). At night, also, the useful light is thrown upon the working planes of the plant more than upon the ceiling.



Wiremold Plant

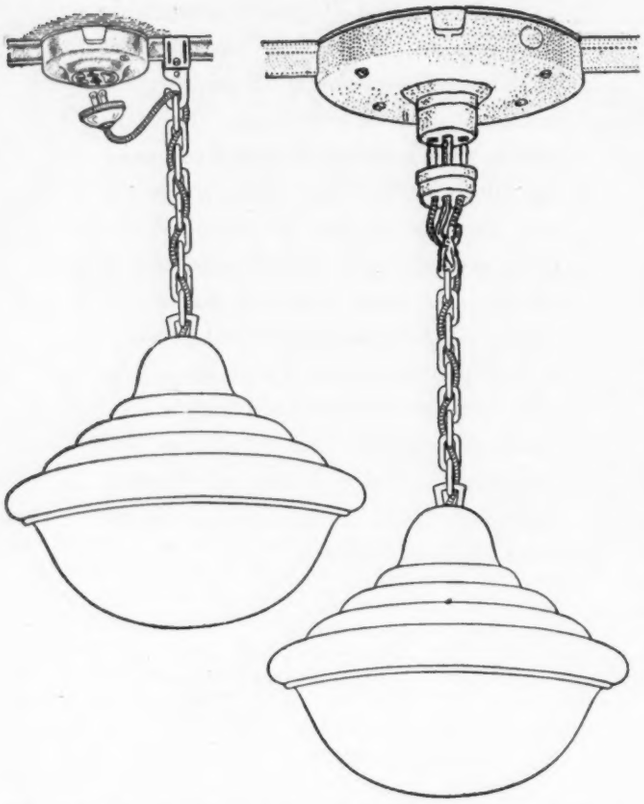
TO ANTICIPATE every reasonable requirement in wiring as a plant develops is a problem of widespread interest and importance. In this article the facilities provided to insure flexible light and power service in the new factory of the Wiremold Company are featured, with breakdown of wiring cost data covering the application of the company's own product to mill construction. Two-phase, five-wire service at Hartford introduced some interesting opportunities for balancing lighting loads and feeding both light and power from a single bank of transformers.

engineer, W. D. Gorman, co-operated in the lighting layout. The Wiremold Company desired to build a plant permitting symmetrical development on a site in the outlying part of the city, and with this objective in mind a receiving substation with two 200-kva. transformers was erected near the center of the ultimate manufacturing group of buildings contemplated. From this point both lighting and power loads are supplied economically even with one manufacturing unit in service.

Flexibility the wiring keynote

The first manufacturing unit is a mill construction building with brick walls, two stories in height and 235 x 89 ft. in plan. The heating plant, die vault, shop employees' retiring quarters and main entrance stairway are located in attached outside inclosures of fireproof construction, so that the main plant may be kept clear for productive purposes. This arrangement simplified the electrical distribution plan, since it permitted symmetrical location of lighting outlets from one end of the manufacturing space to the other, with corresponding uniformity in panel box location, switching and branch circuit disposition. In general, "Wiremold" and its fittings were utilized in the lighting branches and in auxiliary electrical services, rigid conduit and flexible metallic conduit being employed in motor applications. The wiring contractor was the Griffin-Scofield Electric Company, Hartford.

From the transformer bank outside the factory connection is made to the switchboard controlling the various power and lighting feeders by a 4½-in. rigid conduit



Detachable fixture outlet designs used to facilitate installation and maintenance

At the left, receptacle with hook suspension; at the right, a "Diple Thru-Hook" connector serving as canopy, fixture stud, hook, plug receptacle and outlet box. All glass and glass steel lighting units were hung from the fixture hook and plugged into the adjacent receptacle, "R.L.M." fixtures being hung from the "thru-hook" connector.

carrying one No. 4/0 neutral and four 750,000-circ.mil phase wires terminating at a two-phase, five-wire bus at the rear of the board. A spare conduit is provided for future service. In general, power feeders are two-phase, four-wire conductors run in conduit from the factory substation to panel boxes mounted at quarter points in the manufacturing building. From these panel boxes two-phase, four-wire branch circuits are run in conduit to motor groups, fusing being provided in the power cabinets between the taps into the panel box buses and the take-offs of the branches. Motors in general are served by 220-volt ungrounded circuits. The branch circuits feeding individual motors terminate in starting boxes mounted convenient to the machine operator's position, and from these control points the leads to the motors are run in flexible metallic conduit. Each power feeder is fused at the main switchboard and is controlled by a four-pole, single-throw switch of the hand-operated type.

Lighting feeders are fused and switched at the substation bus, and in general the two-phase, five-wire system with grounded neutral is employed, giving 110-volt service on all branches between a phase wire and the neutral and permitting the use in necessary cases of three-wire, 110-volt distribution. The lighting feeders are carried in conduit from the substation to the panel boxes. At

Table I—Lighting Units in Wiremold Factory

(All Units Are Detachable)

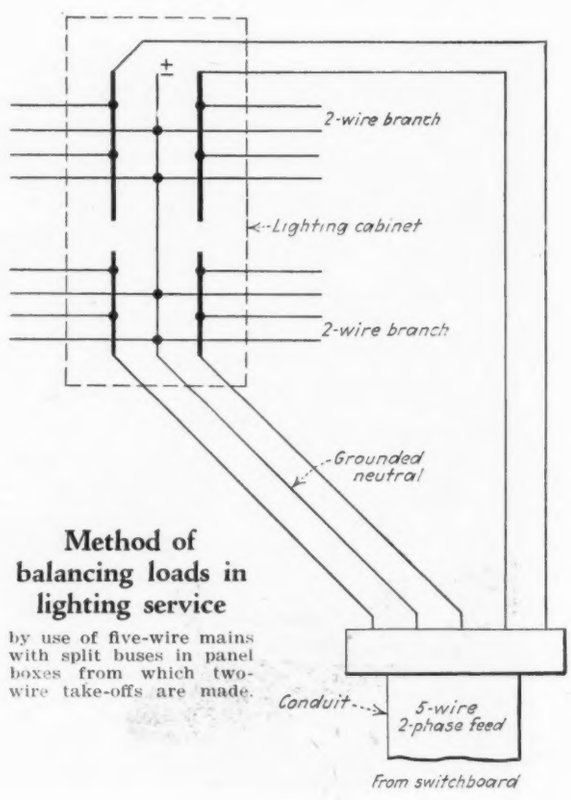
No.	Make and Type	Manufacturer's No.	Size, Inches	Watts	Location
8	Ivanhoe "Glassteel" diffusers	18,750	18	200	Machine shop
6	Holophane "Filterlights"	F-300	..	300	President's office
39	Consolidated "Opal Glass"	6,630	..	200	General office
69	Gillender "Nuglass"	6,671	16	200	Second floor general
8	Consolidated "Opal Glass"	6,680	10	150	General office toilets
27	Gillender "Nuglass"	6,671	10	150	Aisle lights, toilets
51	Benjamin R.L.M.'s	26,016	..	200	First floor, half
64	Wheeler R.L.M.'s	1,722	..	200	First floor, half

Note:—All glass units are hung on chain from "Wiremold" 5708 hook, and plugged into No. 5727 receptacle. Wheeler R.L.M.'s are hung with pipe drop from "Wiremold" 5739. Benjamin R.L.M.'s are hung from "Wiremold" 5738-D "Thru-hook" connector fitting. In stairways 150-watt units were installed.

the latter, circuit loads are balanced by the use of split buses and two-wire branches, with solid grounded neutral carried through the cabinet from top to bottom. Two of the four phase wires completing the five-wire system terminate at the top of the split buses and two complete their run at the bottom.

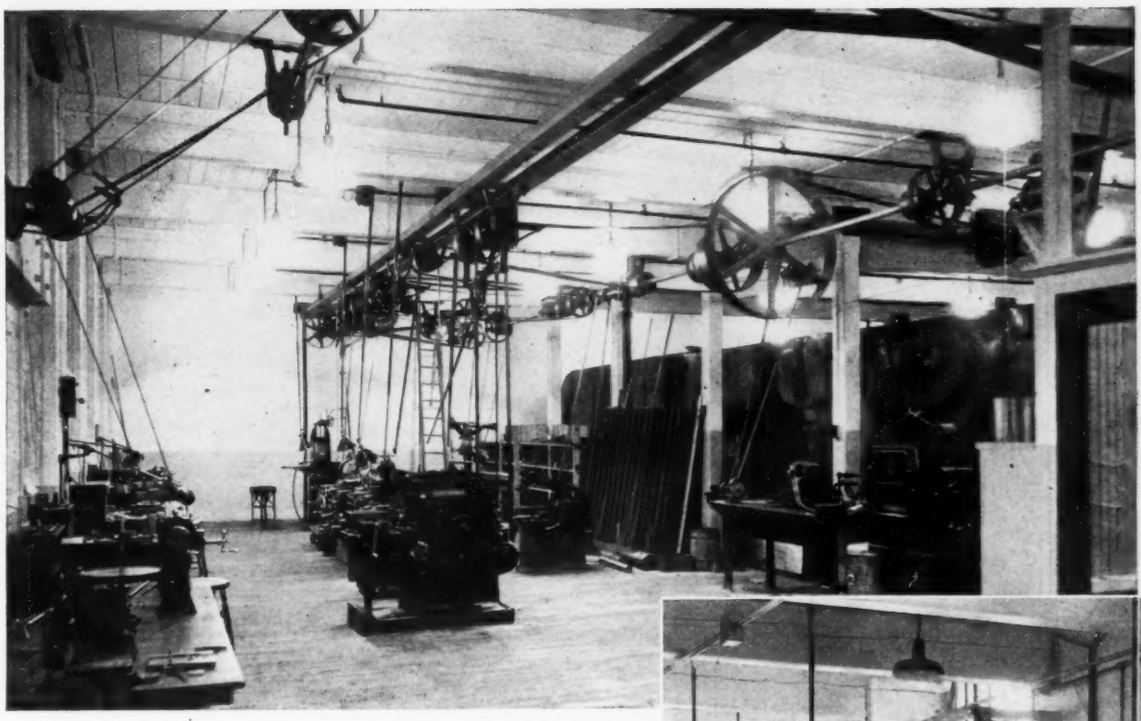
In general, No. 700 "Wiremold" was employed for branch lighting wiring and all main runs where the number of wires carried does not exceed four. On main runs with over four conductors serving lighting loads No. 1,000 "Wiremold" was provided. "Wiremold" run at right angles to the floor and roof beams is strapped around the beams.

The advantages gained by the use of "Wiremold" were as follows: Unobstructed headroom, as the material follows the surface; an inconspicuous installation; the small number of fittings required to do a complete job (only eight different kinds exclusive of elbows and



Method of balancing loads in lighting service

by use of five-wire mains with split buses in panel boxes from which two-wire take-offs are made.



38 ft.-candles used in this shop

This higher than usual intensity was easily obtained by increasing the number of outlets from eight to fourteen and changing the lamp wattage from 200 to 300. The company's standard line of fittings enabled this to be done quickly and with a trifling additional outlay for material. Detachable fixture outlets were a factor in this change.

support fittings were employed); ease of relocating outlets and installing additional ones, since additional lengths can be slipped into outlet fittings and run to any desired point; ease of installation, using a slip joint connection; ample space for fishing in and connecting wires. The flexibility of the installation is illustrated further in the use of certain fittings for multiple applications. Thus, the No. 1028 "Utility Fitting" was employed as a tee, for crosses and for distribution box service. All circuit wiring was completed without thought of fixtures, of their wiring or hanging.

Eight different types or styles of lighting units were installed in this plant to enable the company to study the performance of these in connection with its production and output. In general the fixtures on the first floor, where the major machine operations occur, are equipped with 200-watt lamps spaced 11 x 16 ft. apart and mounted 12 ft. 6 in. above the floor; on the second floor the spacing for general lighting in the packing department, finished parts and finished stock sections is 11 ft. 8 in. x 16 ft., with mounting height 10 ft. 6 in. Here 200-watt lamps are also used. Details are given in the tabulation, which includes offices. The average intensities on a plane 30 in. above the floor were measured as 10.78 ft.-candles on the first floor, 9.3 ft.-candles on the second, 38 ft.-candles in the tool room after improvement, 25.6 ft.-candles in the private offices and 22.49 ft.-candles in the general offices. Every lighting unit in the plant is detachable at ease, the fixtures being fed through receptacles and plugs which are instantly

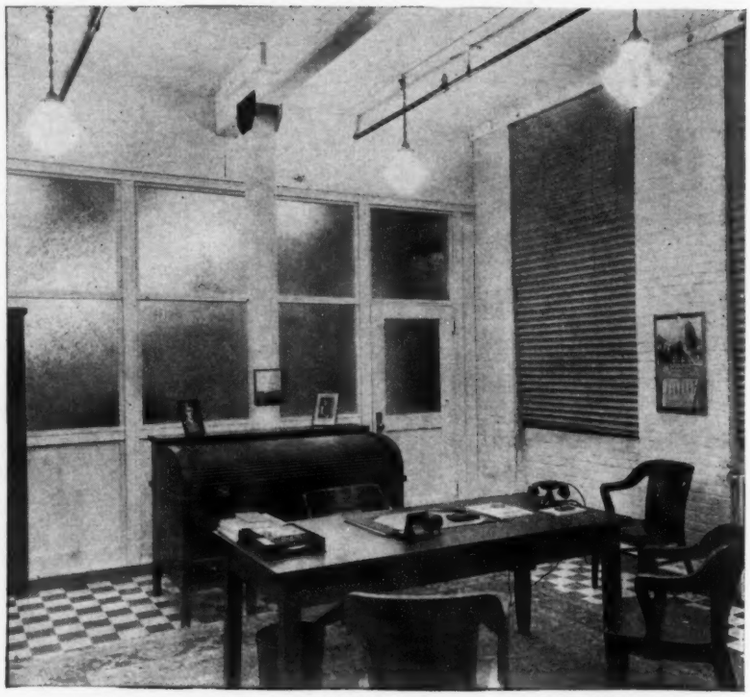
Power wiring reduced to simple terms

This battery of individually driven presses is served by feeding motor groups from horizontal overhead rigid conduit run from the power cabinet installation to the machine tool site. Each motor is served by a vertical drop line terminating in a starting box of the manually operated type mounted on a 6x2x¼-in. channel-iron bolted to the floor. From the starter the motors are fed through flexible metallic conduit. This arrangement permitted quick resumption of tool operation after the tools arrived from the older plant, saving material through the direct runs employed and enabling future changes to be readily made when required.

removable, while the fixtures are hung either from hooks fastened to the "Wiremold" conduit or to special fittings forming a part of this line. This means that in replacing or cleaning a lighting unit the maintainer makes a single trip up a stepladder with a clean or fresh unit in hand. When he reaches the outlet he withdraws the unit needing attention, replaces it with the fresh unit, descends and proceeds to the next outlet. Wiring assembly at the bench is equally simple and no wiring in place is required.

Table I shows the distribution of the various types of fixture units in the plant. The actual foot-candle data obtained from recent tests are given in Table II.

A careful record was kept of the cost of installing "Wiremold" and the associated wiring and lighting fixtures in this plant. The job was handled with exceptional attention and before completion was sprayed with two coats of lacquer, as were the ceilings and side walls, to make the "Wiremold"



Private office at night, showing "Wiremold" conduit and detachable fixture outlet fittings

Uniform distribution and absence of shadows under desks in general office

scarcely distinguishable. H. H. Mandly, vice-president of the Griffin-Scofield Electric Company, states that the costs published in this article are taken from the contractor's field sheets direct, and that these would be lower in an installation where lesser standards prevailed, and probably in close ratio to the quality and completeness of the job with the exception of the cost of installing the wires in the raceways.

The job was manned with the following crew: One foreman at $1.50 per hour, three journeymen at $1.375 per hour and one helper at 75 cents per hour.

For staging and other purposes eight standard painters' platforms were required, seven electricians' ladders (range 6 ft. to 10 ft.) and ten 16-ft. planks of 2-in. x 12-in. section. Two "Wiremold" cutting benches were used, made of plank, stops and simple compression clamps to hold the "Wiremold" and to use two bands on the saw. As the bays varied in dimensions by 2 in.

TABLE II—ILLUMINATION TESTS IN WIREMOLD FACTORY

	Private Office	General Office	First Floor	Second Floor	Machine Shop (Tool Room)
Fixture make	Holophane	Graybar	Ivanhoe	Gillender	Holophane
Fixture class	Filterlite	Nuite 16 x 6 in.	R. L. M.	Nuglas 16 x 6 in.	.....
Fixture number	F-300	9930	B E D D 200	6671	6583
Color walls	Fairly light	Fairly light	Fairly light	Fairly light	Fairly light
Color ceiling	Light	Light	Light	Light	Light
Color floor	Dark	Dark	Dark	Dark	Dark
Height of ceiling	12 ft. 6 in.	12 ft. 6 in.	14 ft. 7 in.	12 ft. 6 in.	12 ft. 6 in.
Mounting height	38 in.*	10 ft. 6 in.	12 ft. 6 in.	10 ft. 6 in.	10 ft. 4 in.
Lamp voltage	115	120	120	120	120
Lamp wattage	300 PS 35 clear	300 PS 35 clear	200 PS 30 clear	200 PS 30 clear	300 PS 35 clear
Circuit voltage	115	116	116	116	113
Plane	30 in.	30 in.	30 in.	30 in.	42 in.
Spacing	8 x 8 ft.	11 x 11 ft.	11 x 16 ft.	118 x 16 ft.	8 x 10 ft.
Average foot-candles	25.6	22.49	10.78	9.3	38

*Over-all suspension of fixture.

maximum, all the lengths of "Wiremold" could not be predetermined and cut in advance to fit without individual measurements. Every piece of "Wiremold" in the plant was put up on a chalk line that was straight and plumb and all drops were put up by plumb bob and level. During the wiring installation the entire factory and office floors were clear of machinery and construction material and were broom clean.

Table III—Cost Data on Wiremold Installation

Quantities of "Wiremold" Required for Factory and Office

920 ft. No. 1,000 "Wiremold" conduit
4,200 ft. No. 700 "Wiremold" conduit
972 ft. No. 704 Straps
200 ft. No. 1,005 Straps
200 ft. No. 5,708 Fixture hooks
185 ft. No. 5,711 90-deg. flat elbows
304 ft. No. 5,717 Internal elbows
190 ft. No. 5,718 External elbows
220 ft. No. 5,727 Plug receptacles
80 ft. No. 5,728 Oblong utility boxes
142 ft. No. 5,738-D "Diple Thru-hook" connectors
67 ft. No. 5,747 Shallow surface type switch and receptacle boxes
15 ft. No. 5,747-2 Gang shallow surface type switch and receptacle boxes
89 ft. No. 5,700-B. L. beam strap
3 ft. No. 1,011 90-deg. flat elbows
172 ft. No. 1,017 Internal elbows
150 ft. No. 1,018 External elbows
69 ft. No. 1,028 Utility boxes
16 ft. No. 1,086 Offset connectors
75 ft. No. 1,000-B. L. beam strap
100 ft. No. 1,000-C

Labor Costs (Unit)

Large type 1,000 line, breaking beams about 10 ft. apart, using four fittings per beam and utility boxes for taps, including "Wiremold" in place; per fitting	$0.46
Pulling in, testing and connecting branch circuit wiring in type 1,000 Line with soldered connection; used colored wires—red, red and tracer, white, white and tracer, black; per 100 ft	1.41
Branch circuit run-outs in type 700 Line on flat ceiling, no beams and no elbows; per fitting, including "Wiremold" in place	1.05
Pulling in, testing and connecting branch circuit wiring in above type 700 Line, per 100 ft	0.91
Branch circuit work in type 700 Line on ceilings, breaking beams in office portion, short runs, "Wiremold" in place; each fitting	0.41
Pulling in, testing and connecting branch circuit wiring in above type 700 Line, using soldered connection; per 100 ft	1.11
Branches in fireproof stairwells running two stories in height, including "Wiremold" in place; no beams to break; per fitting	1.33
Pulling in, testing and connecting branch circuit wiring in above, using soldered connection; per 100 ft	1.20
Branch circuit work in type 700 Line in fireproof toilets, transformer substation, boiler room, including "Wiremold" in place; per fitting	1.10
Pulling in, testing and connecting above; per 100 ft	1.11
Ceiling fixture receptacle with fixture hooks in place; each	0.38

Total costs summarized, with material added and lighting fixtures included

Total labor cost installing "Wiremold" in factory and office	$757.77
Approximate labor cost pulling wires from cabinets to outlets	130.00
Total cost of lighting fixtures	1,117.62
Total labor cost installing fixtures	191.69
Total cost "Wiremold" material figured at standard package prices to contractors	889.72

A real test of wiring convenience

The machine shop or tool room was originally lighted by eight overhead units on 16 x 10-ft. centers, the machines and work benches being equipped with individual lamps for close work. It was found that there was insufficient light to do the rougher work of the shop with this installation, the measured intensity being but 8 ft.-candles. To bring up the intensity it was decided to increase the number of lighting units to fourteen, placed on 8x10-ft. centers, and the lamps were changed from 200 to 300 watts each. In this way the intensity was raised to an average of 38 ft.-candles.

This change made it possible to perform the average work of the shop with only the general lighting in use, because the new intensity was sufficient and heavy shadows were eliminated.

The addition of the six outlets was quickly and easily done by the use of 82 ft. of No. 700 "Wiremold" and six No. 5738-D "Wiremold" fittings. Because the original outlets, as well as the added ones, were of the detachable lighting fixture type it was possible to change from a medium base using a 200-watt lamp to a mogul base and a 300-watt lamp with very little effort. The circuit wiring was completed, the lighting units changed and wired on the bench and when finished were hung on the hook and plugged into the outlet fitting.

▼ ▼ ▼

Safety Activities on Electrical Properties*

VII—Safety Supplies

REQUESTS for safety equipment and supplies, such as goggles, rubber gloves, rubber blankets, ladders and safety belts, are, in many organizations, referred for approval to the safety department, central safety committee or individual in charge of safety work. This insures the purchase of equipment which conforms with state and insurance standards and is best adapted to the purchase for which it is desired.

In most instances periodic tests of equipment and

*See ELECTRICAL WORLD, *April 26, May 3, 10, 17, 24, 31.*

supplies are made to determine whether they are suitable for further service or should be considered hazardous.

Public safety

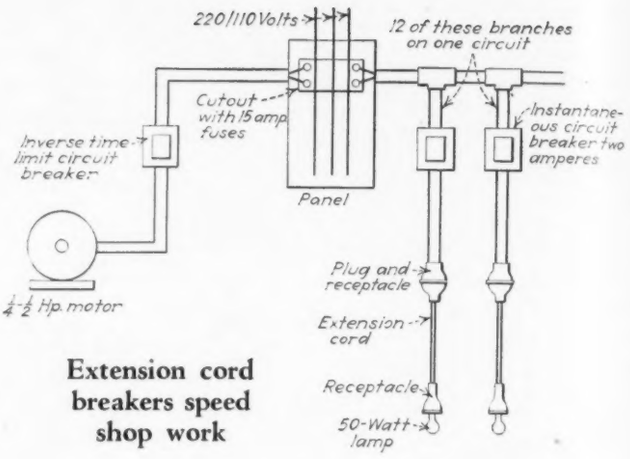
The prevention of accidents among employees demands not only individual interest in safe workmanship but also observation of safe practices while on the street and in the home.

▼ ▼ ▼

Small Circuit Breakers Save Time Losses in Railroad Shop

By G. T. JOHNSON
Assistant Electrical Engineer
New York, New Haven & Hartford Railroad, New Haven, Conn.

SMALL circuit breakers of low ampere rating have been found of great value in maintaining electric service in the repair shops of this company. Formerly it was the practice to rely on fuses to protect extension lamp circuits in a locomotive shop. These extensions were frequently defective, and when the fuses blew delays ensued, with resulting increased labor costs and loss of production until the trouble was found by a maintenance man. With the installation of a 2-amp. instantaneously operating circuit breaker on each extension only the breaker on the extension which is in trouble functions, and usually the man using the extension can locate the defect, repair it and reset the breaker with minimum loss of time from productive work.



Extension cord breakers speed shop work

This experience also led to the use of small amperage breakers with inverse time elements on circuits supplying fractional-horsepower, single-phase, 110- and 220-volt blower motors where the starting currents usually caused the fuses to blow. Interruption time has been cut down, with marked savings in production continuity, and no failures of the breakers have been reported. Such breakers can be operated safely by inexperienced persons and are less liable to be tampered with than other protective devices. The only limiting feature is their cost, which will probably prevent their universal use, especially where protective devices are seldom employed.

Foresees Electronic Tube Replacing Many Existing Devices

By PROF. HAROLD B. SMITH
President A.I.E.E.

THE vacuum tube is rapidly coming out of the category of signaling devices and is developing to a scale where it is capable of handling quantities of power which make it a real tool for the electrical engineer. With tubes now being built with ratings of from 100 to 200 kw. one can see that the electronic era of power equipment is indeed opening up.

Possessing extraordinary versatility in rectifying, converting, changing frequencies, regulating, controlling and performing other complex functions, the vacuum tube presents a new and valuable tool for the electrical engineer in the practice of his profession. It has developed most rapidly within the past ten years, the era of radio broadcasting, as the direct outgrowth of the tremendous volume production of vacuum tubes for radio purposes. Because of this sudden advent, many electrical engineers of the present generation have overlooked its possibilities in purely electrical applications. But the younger group of engineers, particularly those who have had experience in radio, are pressing forward with this vacuum-tube development and the new branch of electronics must soon take its place alongside of and co-ordinate with the older school of electromagnetic machinery.

Not only will the tube supplement and replace tons of moving machinery for converting and transforming power, but it will find uses in switching high-tension currents and as a lightning arrester for protection of lines.

In fact, as the result of the tube's advent, we are likely to witness a complete redesign of our electrical systems in many respects.

The electrical engineer of 1930 is, therefore, giving increasing attention to the whole field of electronic action in vacua, for through the developments here being made he foresees the even wider expansion of the instrumentalities with which he works.

**Statement in June issue of "Electronics."*

What Insulation Values?

Seven questions on insulation for system and equipment proposed and answered. More standardization and less confusion the goal

By M. M. SAMUELS

J. G. White Engineering Corporation, New York

THE relative values of insulation to use on station equipment, transformers, switches and transmission lines is a very delicate subject to discuss because there are probably as many opinions thereon as there are engineers and operators. Each opinion is based on some definite operating conditions or some specific cases of trouble. Therefore it is not surprising to find that most of the discussions seem to be either going around in a circle or running off on different tangents. All the controversy seems to refer to outdoor equipment.

Since each operating company has its definite standards of line insulation, the absolute values to be used for line insulation shall be left out of consideration. But an attempt can well be made to subdivide the various questions which arise in considering the relative values of outdoor station insulation. For example:

1. What shall be the flashover value of transformer bushings in relation to the insulation of transmission lines which are connected to the same bus?

2. What shall be the relation of the insulation of the transformer itself to that of its bushing?

3. What shall be the insulation value of a breaker bushing in relation to that of the transformer bushing?

4. What shall be the insulation value of an insulator on a bus to that of the bushings on transformers and breakers?

5. What relation shall there be between the insulation value of an insulator on a disconnect or a branch in relation to that of the bus or the bushings?

6. What part shall be assigned to the lightning arrester in this discussion?

7. When shall the line insulation close to a station be made lower than the line insulation on the rest of the line?

Since all these questions have been mixed up in a cocktail shaker and discussed as a mixture, there is no wonder that there is confusion, loose thinking and loose arguments in regard to this subject. Even though the proposed subdivision does not state any single question that could be answered without regard to the others, it gives definite lines of demarcation that should permit definite answers to be given to each question in relation to the others.

Suggested answers to questions

1. Every one will agree that it would be desirable to have the transformer insulation higher than the line insulation, because it is obviously much easier to replace an insulator on the line than it is to replace a transformer or even a transformer bushing. But economic conditions make this impossible of attainment. The tendency is to make line insulation ever higher, as high as the available money will permit, and there are some very sound reasons for this policy. When wood poles are used especially with wood crossarms and wood braces, it is almost impossible to state what the line insulation actually is. It would therefore seem hopeless to establish any rule for selecting transformer insulation in reference to line insulation. The standardization of transformers would become impossible and the enormous amount of labor spent on developing standardization would be lost.

The best thing to do is to choose the transformer insulation as high as it is economically possible and then standardize on this value. Even though some extreme cases of transformer failures might have been prevented if still higher insulation had been used, it would not have been profitable to invest a great amount of money to take care of these contingencies.

2. In spite of the fact that some manufacturers are objecting to it, utilities are continuing to specify self-protecting transformers. Eliminating all fine theoretical nuances and all dialectics, and leaving very unusual phenomena out of consideration, a self-protected transformer means a transformer which is so designed that the bushing will flash over before the transformer insulation breaks down. Present indications are that this specification, first formulated by one very important utility group, will be accepted by more utilities as time goes on and will eventually become an American standard. However, there is yet to be developed a generally acceptable testing method to make it possible to establish by commercial routine test that the transformer is so designed and built. A specification which cannot be checked by simple test is useless, and the several societies involved should come to a definite agreement on standard tests—the sooner the better.

3. For some time there was a strong movement to-

ward standardization of bushings, with the object in mind to be able to use the same bushing on a transformer and breaker of the same voltage rating. But recently serious doubts have been raised as to the advisability of this standardization. It is contended by a number of engineers that the breaker bushing should have a higher value than the transformer bushing, so that when something has to flash over, preferably it should be the transformer bushing, leaving the breaker intact to clear the circuit. This is a very valid argument that cannot be brushed aside in an offhand manner.

Must differentiate between purposes of breakers

A failure of a breaker connected to a powerhouse bus is likely to cause a shutdown of the whole plant because there is no further protection between the breaker and the bus, whereas a flashover of a transformer bushing would only affect the individual circuit if the breaker between the transformer and the bus functions properly and clears the circuit. The case is somewhat different on breakers which are not connected between transformers and buses, or in the case of substations, so that a differentiation would have to be made between breakers used on different circuits of the same voltage. This again would destroy all breaker standardization and produce an impossible state of affairs in this field. It is possibly for this reason that this argument is generally not used in favor of raising the insulation of breakers, but in favor of lowering that of transformers, so that the argument does not lead to a very desirable conclusion.

Furthermore, this argument when followed to its logical conclusion would appear to mean the use of a transformer as a fuse to protect a switch, an idea quite difficult to digest. The hardened operator will say that if something has to go, by all means let everything go except the transformer. Having a good transformer available he can, in emergency, give his customers service without any switching whatever, but of what avail is switching equipment when there is no energy supply?

The issue becomes still more confused when some of those who advocate different bushings for breakers and transformers do so only for a certain range of voltage, but not for all voltages, and others advocate differentiation of bushings for sea level, but not for higher altitudes. Since it is not a question of absolute, but one of relative, insulation, it is difficult to see why the same rule should not prevail for all voltages and all altitudes. Is it that some definite economy in the design of self-protected transformers has something to do with it? The differentiation of altitudes would seem to point to such a reason. There are thus two aspects of this most important question. They should be discussed fully from all possible angles. Offhand it would seem that the operator, in the end, would desire the same bushing on his transformer and breaker and be content to take his chance with good lightning arresters for protection.

4. It seems to be generally conceded that the bus insulation should be as high as possible, and further discussion of this feature seems unnecessary.

5. The idea is often expressed that if there is a choice as to where a flashover should take place, the insulator on a disconnecting switch or a branch connection should be chosen for the purpose. This is plain folly, because the argument would only hold good for such insulators as are on the breaker side away from the bus, so that they could be disconnected by a breaker. The disconnects and insulators between breaker and bus are in the same boat as the bus. Two types of insulators would have to be used, leading to impossible complications. The same insulators should be used on disconnects and branch connections as are used on the buses. In this connection it may be worth mentioning that arcing rings, ground shields and similar devices should be left out of this discussion, because they would only tend to becloud the issue, which is one of relative values and not absolute values.

6. Lightning arresters are now not provided for protecting transmission lines, but for protecting station equipment from troubles arising on transmission lines, and arresters should therefore be located as close to the equipment which they are to protect as it is physically possible to place them. The old custom still seems to prevail of providing an arrester on each line, but the time seems to be ripe to consider a lightning arrester for each transformer, located close to the transformer. With the new types of arresters it may be worth while to consider the building of the arresters as part of the transformers. However this may be, if the arrester is considered as a reliable piece of equipment, which fails to function only in extremely rare cases, it would seem logical to standardize on using the same insulation values on all exposed parts of the same station of the same voltage, using self-protected transformers and depending on the arresters for further protection. Otherwise, what is the lightning arrester for, after all?

7. It has been suggested that it is good practice to reduce the line insulation on the last tower or the last two towers close to a station, in order to make the insulator on these accessible towers the "flashover insulators." Since it has been established that most surges do not travel very far on transmission lines, this introduction of weak links in the line, which are comparable to fuses, could only serve the purpose of station protection. This may be a practical proposition, but here, too, the question may be asked, What are the lightning arresters for, anyhow?

These are all very important questions, and the answers given here to some of them are not intended to be definite, but are set forth to bring out further discussion. More standardization and less confusion is the goal.

The Operator to the Stockholder

"THE success of the institutions I have been responsible for has been based upon the treatment that we have accorded those who have put money in our institutions with us. We do not ask them to go in on any other basis than the basis upon which we go in ourselves. We are not looking, from day to day, merely to fulfill the legal obligations owed to a stockholder. We have in mind all the time the moral obligations that the operator owes to his stockholders."

SAMUEL INSULL.

Record Customer Sales —Prospect for 1930

By E. PAUL YOUNG

President E. Paul Young & Company, Inc., New York

THE chairman of the board of a great public utilities corporation was discussing the financial situation with his business associates. It was November, 1929. The wide-open break on the market had sent professional speculators and their victims and imitators scurrying for cover. The gambling public, caught in the vortex of sinking stocks, wailed despairingly as Wall Street developed ticker ague.

The chairman spoke.

"This market debacle is a costly but graphic illustration of the folly and danger of speculation," he said. "It affords also to holders and purchasers of dependable securities the pleasure of dwelling upon their wisdom in investing in stocks for safety and yield rather than for chance and fortuitous gain."

Pausing for a moment, the executive glanced at a typewritten report. He addressed his next words to his operating vice-president:

"This brings me to our own problem of financing," said the chairman. "In 1930 this company will need money to expand and to increase its operating facilities. Fifty per cent of this money will be raised locally."

"Meaning——?" asked the vice-president.

"Our employees and our customers," replied the chairman. "In other words, customer ownership.

"This corporation is sound. Our employees and customers know what we are doing and how we are doing it. We offer for a good reason a good investment paying a good dividend. Through an issue of preferred stock, we will raise the money we need and give every employee and customer an opportunity of becoming a partner in our business."

This incident is quite authentic. The principals in the anecdote guide the destiny of one of the largest public utility corporations in America.

The company had no difficulty whatever in raising "50 per cent of the money needed" among its employees and customers.

The year 1930 promises to be a record one in the matter of customer ownership. I believe that the total amount of money invested by customers in the preferred stock of public utility corporations this year will triple the amount invested similarly in 1929.

There are many logical reasons for this unprecedented interest in customer ownership. One of the most important of these is that a number of companies have not distributed any shares for two or three years and a new mass of customers, their investing appetites whetted by seeing customer owners who were fortunate enough to buy stock when last issued by these companies receiving their regular dividend checks, are waiting eagerly for their chance with the 1930 issue.

In the same analysis, it may be said that customer stock owners are the best customer stock salesmen. It is a biological vagary that human beings are given to exult in the good things fate—or a good business sense—has bestowed upon them.

Particularly is this true of the customer holder of preferred stock in the public utility corporation with which he does business. He is, in every sense of the word, a partner in a mammoth organization—and he tells the world he is.

He refers proudly to "his company" and talks enthusiastically to his friends, neighbors and acquaintances about the service "my company is giving" and the expansion "my company is planning."

Important good will factor

This investor's enthusiasm is not measured by the size of his investment nor by the number of shares he holds. It is measured by his loyalty to a corporation he knows—and works for or buys from; by his faith in a corporation which protects his investment, large or small, with tremendous assets and ethical business principles and pays him regular dividends, and, to some extent probably, by justifiable pride in his shrewdness as an investor.

This is good will, quite the most valuable asset any public service corporation can possess. A customer owner's enthusiasm sows prolific seed for the next financial harvest.

The operating head of one of the greatest companies sums up customer ownership in these words:

"Customer ownership of preferred stock in any company is the one sure way of getting the thorough, if not entire, support of any community. It brings about an era of good feeling, influencing not only those who receive their quarterly dividend checks but all their friends and neighbors. It arouses interest in the patrons of the company through correct information regarding its activities—and the saving and investment—which can be had in no other way."

This man not only advocates customer ownership; he uses it.

Soundness of investment is another factor that commends customer ownership. A public utility corporation is dependent upon its customers for its success. Obviously, it cannot afford to violate the public trust; to offer its customers a hazardous investment would be financial suicide. So the prospective customer investor has the added protection of the company's adherence to the first law of nature, self-preservation. No utility corporation can evade its responsibility to itself.

The advantages of this type of local financing is touched upon by Roger W. Babson, noted economist, as follows:

"The policy of local financing encourages thrift among the mass of the people by pointing out the advantage of saving and by offering them a sound investment in an enterprise which they know about, operating under public regulation and offering securities purchasable in small amounts."

Another point to be considered in customer ownership is the class of investor. Customer buyers are not, as a rule, experienced investors. They buy for safety and yield. A plain statement of fact, combined with their own observation of the company in which they are invited to become partners, is the basis upon which they buy shares. They ask security and a fair yield.

A sound economic policy

A New York woman industrialist, who has amassed many millions of dollars, said apropos of the 1929 market break:

"The moral that the crash pointed out so plainly—that something for nothing is impossible—is of benefit to legitimate business.

"If Wall Street will shock people back into a sense of sound business, it will do the greatest good imaginable."

Wall Street has done that very thing. It has taught many investors that safety first is a slogan as applicable to stocks as to traffic. And it added very materially to the customer-ownership army.

Customer ownership is economically sound. A survey of customer-ownership strongholds which I made recently showed that even during the darkest period of financial hysteria, with Wall Street capturing the front page of every newspaper in the country, customer stockholders made no attempt to "cash in" on their holdings. Test evidently has proved the panic-proof qualities of this type of security.

Every well-managed company can improve its financial structure and better its customer relations through customer ownership and every employee and customer of a utilities corporation can improve his financial status and community relations through customer ownership.

Writing in the "Analist" (New York *Times*) Alfred J. Williams predicted recently:

Will still discount future

"If utilities continue to 'get the breaks,' five years from now they will undoubtedly still be discounting five or ten years ahead and investments at current levels would result profitably."

It seems to me that our present rate of national progress assures the future of public utilities.

Advance figures of the federal census tell the story. Healthy increase in population; splendid development in towns and cities; increased capital wealth and credit capital; sturdy growth.

National expansion means utilities expansion. Utilities expansion calls for investment. Utilities investment marshals the mass of employee and customer investors, for time and experience have shown that customer ownership is the most practical method of raising money for corporate purposes when it is needed—money which brings with it good will and understanding that no money can buy.

RECOMMENDED COLOR SCHEME FOR CONTROL CABLE

Sponsored Jointly by the N.E.L.A. and N.E.M.A. Committees

	Base	Tracer	Tracer
1.	Black		
2.	White		
3.	Red		
4.	Green		
5.	Orange		
6.	Blue		
7.	White	Black	
8.	Red	Black	
9.	Green	Black	
10.	Orange	Black	
11.	Blue	Black	
12.	Black	White	
13.	Red	White	
14.	Green	White	
15.	Blue	White	
16.	Black	Red	
17.	White	Red	
18.	Orange	Red	
19.	Blue	Red	
20.	Red	Green	
21.	Orange	Green	
22.	Black	White	Red
23.	White	Black	Red
24.	Red	Black	White
25.	Green	Black	White
26.	Orange	Black	White
27.	Blue	Black	White
28.	Black	Red	Green
29.	White	Red	Green
30.	Red	Black	Green
31.	Green	Black	Orange
32.	Orange	Black	Green
33.	Blue	White	Orange
34.	Black	White	Orange
35.	White	Red	Orange
36.	Orange	White	Blue
37.	White	Red	Blue

Cost Comparisons Decide Houston Network

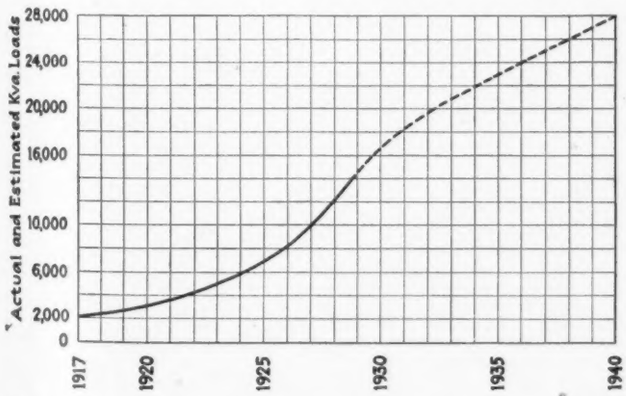
By G. C. PLUMLEY and E. F. SEAMAN

Underground Distribution Engineer and Assistant Distribution Engineer, Respectively, Houston Lighting & Power Company, Houston, Tex.

Four possible ways of caring for the expected ten-year load increase in the business district of Houston were given consideration. Cost analyses of the four methods permitted a selection to be made, based entirely on economic factors

THE rapid growth of load and the expansion of the underground distribution system in Houston's business area made advisable an economic survey of existing conditions and a forecast of expected growth through the period of 1930 to 1940, based upon the experience of the past several years. With the aid of the facts thus established it was decided to recheck the investment and engineering forecast with the view of determining the changes advisable from the standpoint of maximum economy and efficiency to be gained from the invested dollar with the greatest apparent continuity of service through the period to 1940.

In the past a 4-kv. radial feeder system has been used, supplied from a substation (Gable Street plant) approximately 1 mile from the downtown district. In the last four years it has been necessary to add seven feeders, making a total of thirteen feeders, with an average length



Load curve extrapolated to show ten-year growth

of 5,600 ft., supplying this section. This addition of feeder capacity in terms of increased kilovolt-ampere demand is shown in the curve, which was plotted with actual load values from 1917 to 1929. From this point the curve was extrapolated and the value for 1940 predicted from the trend of the curve and from the potential industrial development within the boundaries of the underground territory. From the load thus obtained and the estimated limits of the underground duct system a comparatively high-load density results as follows:

Year	Load	No. Blocks	Load Density (Kva. Square Mile)
1929	15,000	92	41,700
1932	20,000	154	33,300
1940	28,000	194	21,000

The above load density is illustrated on the map. This map shows the section of the city that has been studied, the present Gable Street plant, and three proposed substation sites. It would be necessary to use one of these sites if system designs (1) or (2), that are discussed later, were adopted.

Referring to the map it will be noted that the northwest boundaries of the subway system are definitely set by Buffalo Bayou, which flows through that portion of the city, and beyond which it is not deemed advisable to extend underground distribution for some time. The eastern and southern boundaries have been determined by the extent of the present duct system and probably future extensions.

A high-load density in blocks where important customers are served, the successful operation of numerous recent secondary network installations, the economical use of that duct space allotted to primary feeders and a maximum amount of realization on the investment for the present distribution system brought under consideration the following plans: (1) Extension of 4-kv. radial systems; (2) 4-kv. radial and 4-kv. network; (3) 4-kv. radial and 12-kv. radial; (4) 4-kv. radial and 12-kv. network.

TABLE I—COMPARATIVE INVESTMENT COSTS FOR VARIOUS DISTRIBUTION SYSTEMS

Item	Description	Per Cent of Cost of 4-Kv. Radial + 4-Kv. Network	Per Cent of 4-Kv. Radial 4-Kv. Radial + 12-Kv. Radial	Per Cent of System 4-Kv. Radial + 12 Kv. Network
Secondary system Cable mains Ducts and manholes Junction boxes Network switches	Total investment cost (1) Investment cost by years to 1940 (2)	157 375	100 100	157 375
Primary system Feeder cable and conduit Mains and conduit Junction boxes Primary switches Primary fuses	Total investment cost (1) Investment cost by years to 1940 (2)	83.5 69.5	101 63	51.6 147
Transformers and vaults Transformers Vaults	Total investment cost (1) Investment and cost by years to 1940 (2)	79 145	94 100	79 145
Transmission system	Total investment cost (1)	100	None	None
Cable ducts and manholes	Investment and cost by years to 1940 (2)	100	None	None
Substation cost exclusive of regulators and breakers	Total investment cost (1) Investment cost by years to 1940 (2)	100 See below	None None	None None
Regulators and breakers	Total investment cost (1) Investment cost by years to 1940 (2)	89 95.5	54.5 21.8	35.3 66
Power plant equipment and transmission	Total investment cost (1) Investment cost by years to 1940 (2)	100 100	100 100	100 100
Total cost	Total investment cost (1)	96.5	69	57
	Investment cost for 1929 (2)	114	76	46.5
	Average expenditure per year except 1933 (3)	85.5	78.5	71.3
	Substation and transmission expenditure in 1933 (4)	100	None	None
	Total for 1933 (5)	95	25	23

It might be questioned here why a 12-kv. radial system was not considered. This was impracticable since a great many of the present 4-kv. vaults could not be converted into 12-kv. vaults, due to lack of space.

Estimates of the comparative costs of the above systems are tabulated in Table I. This table is arranged (1) as to total investment and (2) as to investment per year up to 1940.

From a study of the table it will be noted that the greater saving is effected by the use of a 4-kv. radial and

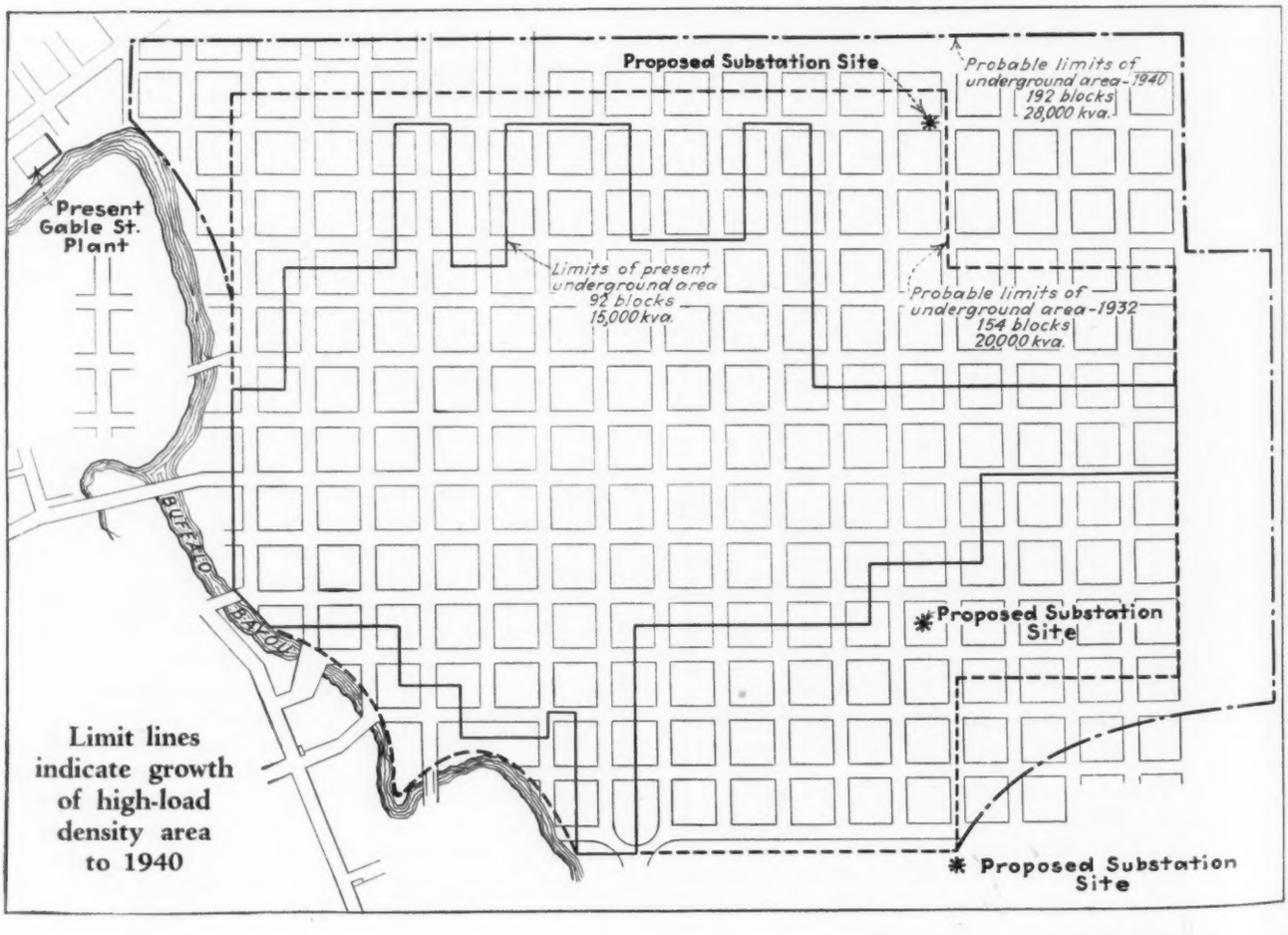


Table II—Summary of Costs of Various Distribution Systems

Item	(Per Cent of Cost of 4-Kv. Radial Plus Network System) 4-Kv. Radial	4-Kv. Radial + 12-Kv. Radial	4-Kv. Radial + 12-Kv. Network
A. Cost of useful property	130	87	81.5
B. Cost of abandoned property	None	97	116.5
C. Net salvage from abandoned property	None	112	125.0
D. Net loss (B-C)	None	54	91.6
E. Property additions necessary 1928–1940	98	66	52.5
F. Total cost of property 1940 (A+D+E)	104	71	59.5
G. Fixed charges on total cost at 14 per cent.	104	81	59.5

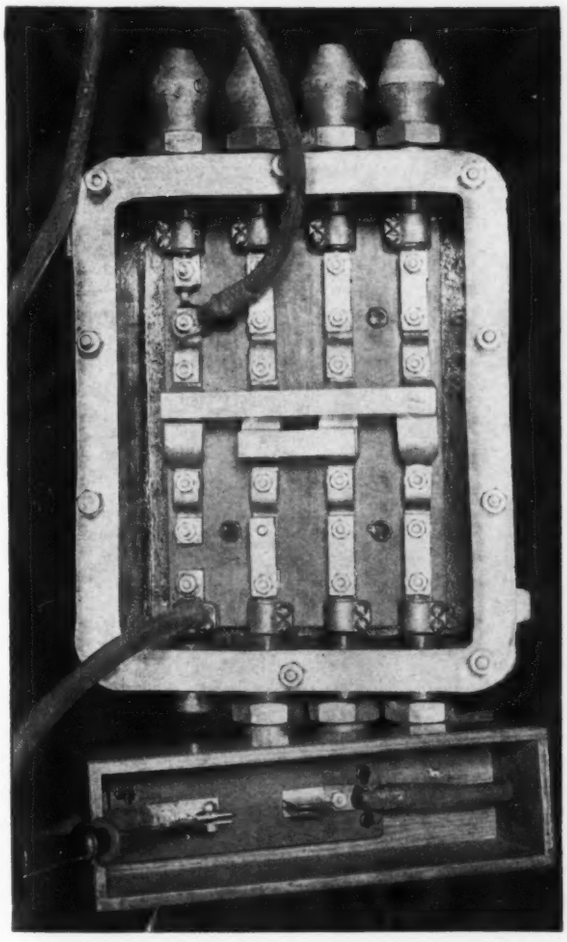
12-kv. network system, and that a favorable comparison is offered to this by the 4-kv. radial and 12-kv. radial system. The two other plans are much higher than this and of the same order due to the necessity of a substation in 1933 and the installation of approximately 1½ miles of 33-kv. underground transmission to serve this substation.

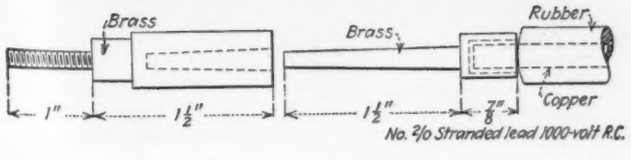
The costs as shown in the tables are based on the utilization of the present No. 4/0 secondary cable and the addition of one set of 400,000-circ.mil secondary cable where networks were considered. No change was contemplated in primary conductor except the addition of some No. 2/0 12,000-volt cable for primary mains under systems (3) and (4).

From the foregoing it can readily be seen that a combination of a 4-kv. radial and a 12-kv. network system represents a design that will result in a great saving over other systems for this particular area, as well as the assurance of good service and the continuity of service expected from network operation. As a result of these conclusions the above-mentioned combination network system has been adopted and is now in the process of being cut in.

▼ ▼ ▼

A Convenient Short-Circuiting Switch





CONSIDERABLE hazard has always attended the practice of picking up or dropping load by the installation or removal of fuse links in underground junction boxes. With any appreciable amount of load it has been necessary to kill the transformer in order to put in or remove links, because of arcing or spitting. On occasions the link has "frozen" at the first contact and could not be tightened up. To do away with this danger, the Malden (Mass.) Electric Company devised the switch and fittings illustrated, the objective being to short-circuit the link being replaced or removed, with corresponding continuity of service.

The switch itself is a 200-amp., 250-volt, jack-knife switch inclosed in a wooden box, open at the front. There are two hooks on the back by which the box can be hung in any convenient place. The leads are of very flexible 210-strand, No. 2/0, 1,000-volt "Tirex" cord. The left-hand lead, as shown, has a 200-amp. lug which fits on the stud holding the link nuts. These studs are long enough for the lug and extra nut to be installed without disturbing the underneath nut which holds the links. The other lead has a two-piece terminal as shown in the accompanying sketch. One part is threaded and is screwed in the place of one of the screws holding the stud. This piece is drilled out and the other part fits into it. Both pieces are tapered slightly to insure a good fit and to prevent the plug piece from pulling out when in use.

For the installation of a link the procedure is to set the box up, connect as shown and close the switch. Then the link can be put in without any arcing. When the link is in place the switch is opened and the leads removed. This arrangement has eliminated a hazard and speeded up work, besides reducing interruptions to service. A double-pole switch is also available for use in three-wire 115/230-volt sections.

Open junction box with link and bypass switch open and detail of two-piece terminal

Half-Degree Temperature Control

By W. B. KOUWENHOVEN and S. K. WALDORF

Johns Hopkins University

THE vacuum tanks used in determining the electrical properties of insulating oils and paper are surrounded by oil jackets and the control is effected by the variation of the currents in resistance heaters placed within these baths. The temperature of each of the tanks had to be controlled independently of the others at any desired value from 30 to 110 deg. C. The method of control developed avoids undue duplication of expensive electrical apparatus and yet permits absolutely independent automatic control of the temperature of any tank. At the same time, independent measurement of the temperature in each tank may be made.

The control method is based on the use of resistance thermometers in conjunction with a Wheatstone bridge, a thermometer in each tank forming one arm of the bridge. A selector is employed to connect the bridge to the resistance thermometer of each tank in turn and to connect the relays regulating the heating currents to the control. Once each minute a clock circuit closes the contacts on the galvanometer relay of the bridge to operate the proper polarized heater relay for increasing or decreasing the heating current.

When only a single tank is in use, the selector does not revolve, but is left in position to control that tank. When two tanks are in use the selector revolves to make contact for each tank every other minute. With all three tanks in operation the temperature of each tank is automatically checked once every three minutes. The number of tanks controlled may be changed at will.

Resistance Thermometers.—Each tank is provided with three copper wire wound resistance thermometers, two inside and one outside. Each thermometer has a resistance of about 82 ohms at 30 deg. C. One of the thermometers inside the tank is centrally located within and close to the high-voltage electrode of the test con-

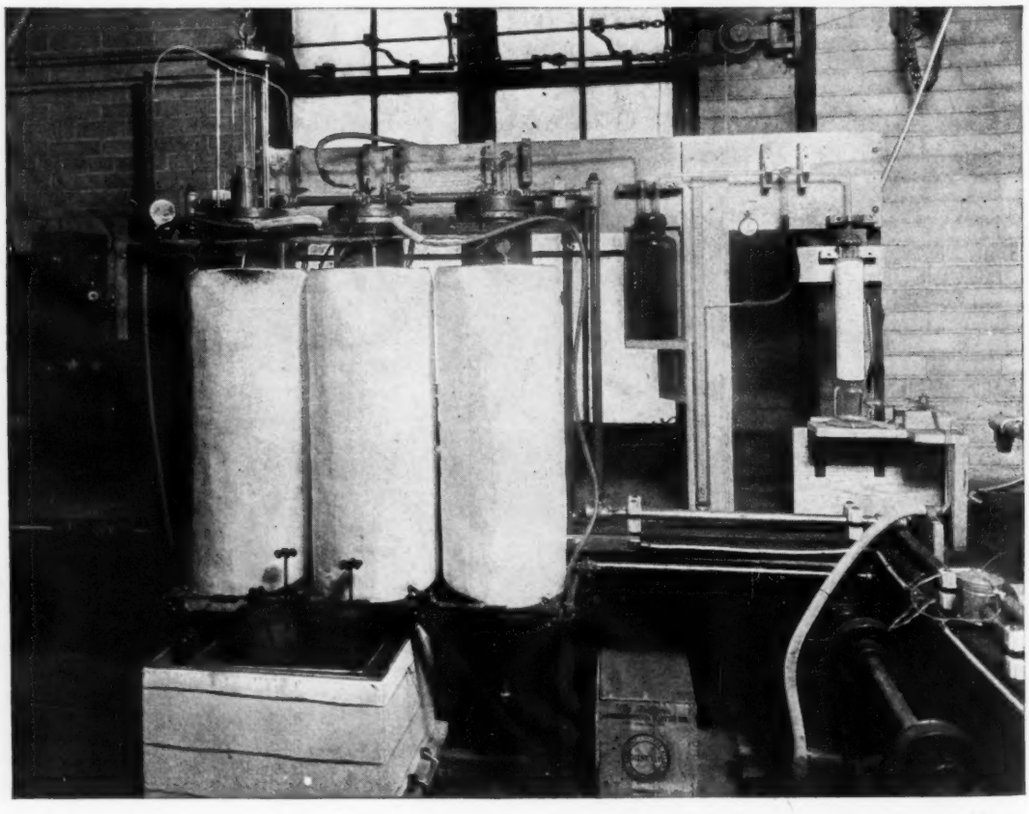


Fig. 1—Vacuum tanks are surrounded with oil jackets and temperature control is effected by immersed heaters

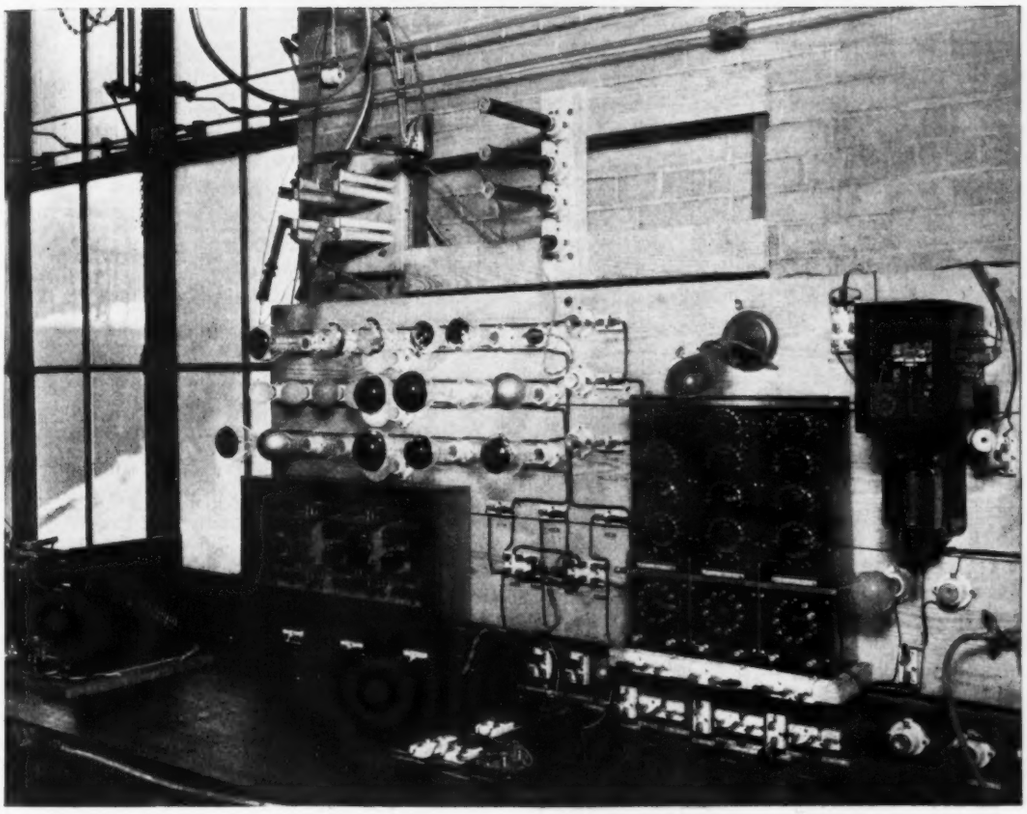


Fig. 2 — Control board and equipment for dielectric tests

IN CERTAIN experimental research on the electrical properties of insulating oils and of impregnated paper, now under way in the Johns Hopkins University under the auspices of and the support of the Utilities Research Commission, it is important that the temperatures of three small metal vacuum tanks of about 5 gal. capacity each be maintained closely constant and at times at different values.

THIS article describes the temperature control which was devised for the purpose and which holds the temperature constant within less than one-half of 1 deg. C. As this control has some new features, it is thought that it will have general interest. Through the courtesy of the Utilities Research Commission a description of this apparatus is offered at this time, in advance of the completion of the results of the principal investigation.

denser. The upper end of the bakelite tube upon which this thermometer is wound is visible in Fig. 3, projecting slightly above the high voltage electrode. The second thermometer within the tank is mounted between the specimen and the tank wall and is just visible at the left of the illustration. It is used for following temperature changes inside the tank. These two thermometers are used in the manual measurement of temperature. The thermometer in the heater oil bath surrounding the tank is used for the automatic control of temperature.

Wheatstone Bridge.—The circuit diagram of the Wheatstone bridge is given in Fig. 4. The bridge galvanometer is of the contact-making wall type manufactured by the Leeds & Northrup Company. The galvanometer and the three variable bridge resistance arms, one for each tank, may be seen at the right of Fig. 2. These resistance arms are each adjustable to a tenth ohm.

For the complete and convenient measurement of the tank temperatures the circuits can be readily connected to any one of the three thermometers of a tank by means of the three point switches S_2 in Fig. 4. The bridge is also provided with an ordinary table type of galvanometer and bridge key for the manual measurement of tank temperatures. When the bridge is in operation as a control device the contactor galvanometer is in the circuit and the bridge battery permanently connected.

Heating Circuits.—The heating current through the heater resistance in the oil bath of each tank is regulated by a series lamp bank. These individual lamp banks, one for each heater, are divided into two sections, one of which is permanently connected in the heater circuit. The other section is connected or disconnected from the circuit by the polarized relay as more or less current is called for by the control.

A temperature change of about a third of a degree centigrade is required to operate the control. By placing the control on the thermometers in the tops of the outside oil baths, where the changes are most severe, it has been found that the temperatures within the tanks themselves can be maintained constant to within a tenth of a degree.

Selector.—To use one set of control apparatus for three separate tanks, all of which may be at different temperatures, a motor-driven selector switch has been employed for connecting the control apparatus to each tank in turn. The device connects the bridge resistance arm and thermometer of a tank to the bridge and the corresponding polarized relay into the contacting circuit of the bridge galvanometer. When the timing impulse comes at the end of a minute, the polarized heater relay is changed or left unaltered, as the resistance of the tank thermometer indicates. The selector then moves on to open these circuits and to close those corresponding on the next tank in order, to await the timing impulse at the end of the next minute, when the heater current of this second tank is regulated as needed.

A simplified diagram of the connections of this selector is given in Fig. 5. The selector may also be seen in the lower left-hand corner of Fig. 2, with its dustproof glass cover removed. The contacts are made by spring metal fingers on the movable arm sliding over circular tracks mounted on the stationary vertical faceplate of the selector. In Fig. 5 only the conducting portions of the tracks are indicated.

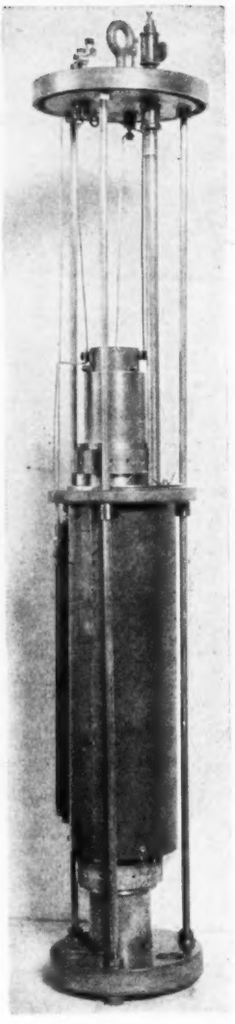


Fig. 3—Each tank has three copper wire resistance thermometers, two inside and one outside

The rotating arm moves slowly, taking eight seconds to move from the control position of one tank to that of the next. This slow motion is obtained with a reducing train of gears driven by a very slow speed motor. When in position for the control of temperature on tank A the insulating arm is in the vertical position, with the eleventh metal finger (counting outward from the axis of rotation) resting on the top insulating break in track 11. It can be seen in Fig. 4 that with the switch S_1 closed to the right the bridge circuit is complete. The polarized tank A heater relay is connected in the contactor circuit of the galvanometer by the bridging of tracks 9 and 10 on the selector.

For 0.8 second every minute a clock

Fig. 4—Circuit diagram of Wheatstone bridge

There is a separate heater relay, bridge resistance and set of thermometers for each tank.

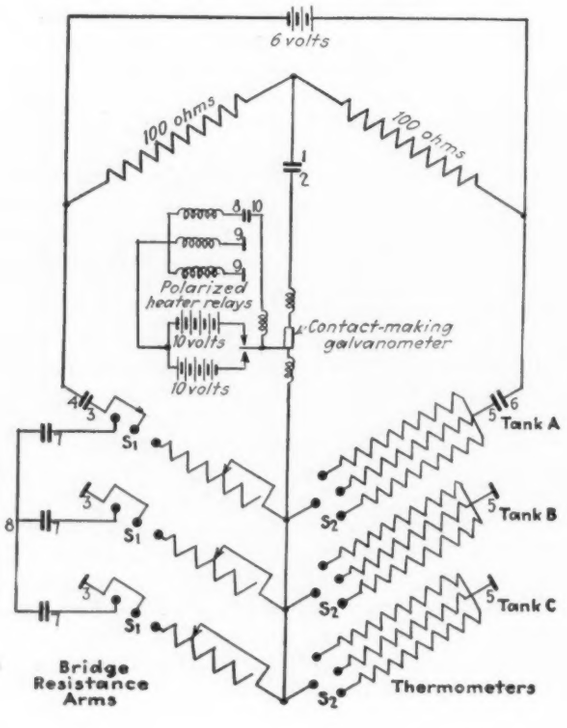
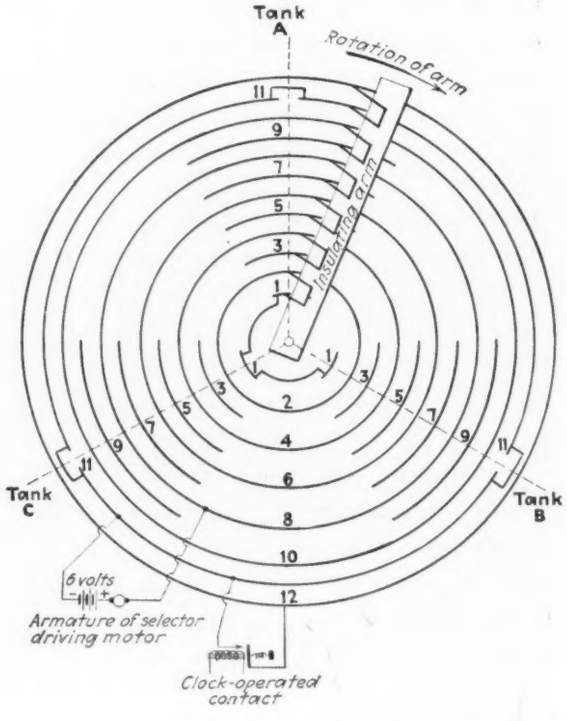


Fig. 5—Tank control rotary selector

The track segments are connected to corresponding numbered contacts shown in Fig. 4.



closes an electric circuit to energize a relay for operating the contacts of the bridge galvanometer. By means of a second relay this same timing impulse short circuits momentarily tracks 11 and 12 on the selector, causing the selector motor to run and rotate the insulating arm. When the arm has moved only a short distance the eleventh finger rests on a conducting portion of track 11, keeping the armature circuit closed after the timing impulse has passed. The arm will then move until the next break occurs in this track, when the contacts for tank A will have been broken and those for the next tank closed. The conducting portions of track 1, closing the galvanometer circuit, subtend a smaller angle of arc than do the corresponding segments in the other tracks.

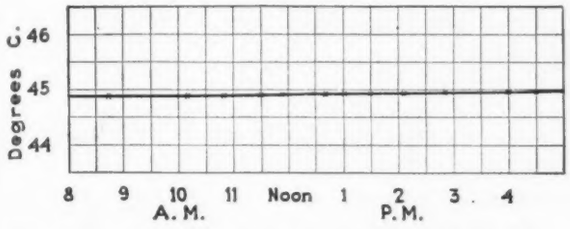


Fig. 6—Typical temperature record of a specimen of cable compound at 45 deg. C. as measured by an inner resistance thermometer

This connects the galvanometer to the bridge after all other contacts have closed and disconnects it before they open, eliminating shocks to the instrument.

If a tank is not in use the control can be made to skip it by leaving the corresponding S_2 switch (Fig. 4) entirely open and closing the companion S_1 switch to the left. This switching leaves the selector motor armature energized through the segment in track 7 when the regular energizing finger comes to the insulating break in track 11. In this way the arm does not stop in the control position for an unused tank, but only in those positions corresponding to used tanks.

Limits of Control.—This apparatus has been used successfully to give closely regulated temperatures from 26 to 110 deg. C. The lower limit is fixed by room temperature, which should be not less than 3 and preferably 6 deg. below the desired tank temperature for dependable control. The upper temperature limit is fixed by the flash point of the oil in the heater jackets. Fig. 6 shows a typical temperature record of a specimen of cable compound at 45 deg. C. as measured by the inner resistance thermometer. The variation is less than a tenth of a degree centigrade and clearly brings out the effectiveness of the control. During usual measurement periods, extending over several hours, specimen temperatures rarely vary more than a twentieth of a degree.

This system of control may be extended to operate more than three tanks simultaneously. Additional contacts may be provided on the selector dial as desired, and the speed of operation may also be changed by using a clock that makes contact at more frequent intervals than once a minute. The control is simple and effective and uses apparatus that is readily available or easily constructed.

▼ ▼ ▼

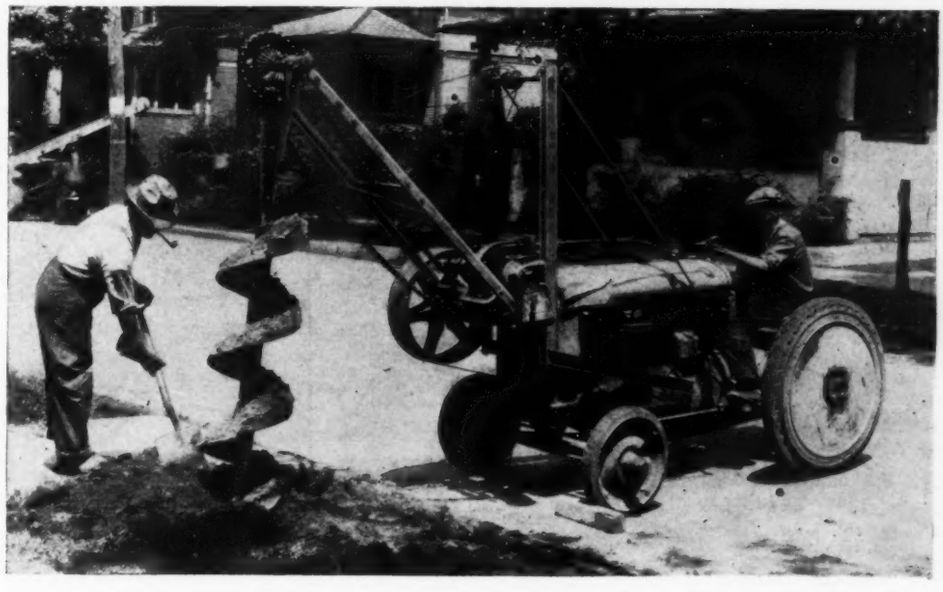
Improvised Post Hole Digger

By R. J. DRAKE

Street Lighting Engineer
Public Service Company of Northern Illinois, Chicago, Ill.

A POST HOLE digger which is quite different in appearance and operation from those familiar to the industry in the construction of overhead lines was used in a street-lighting installation in a Chicago suburb. It consists of a Fordson tractor which carries on its bow a short crane from the end of which is suspended the digging screw. The digging mechanism was locally designed and built at a cost of $375. As the accompanying illustration shows, it is extremely simple and depends for its digging capacity on the weight of the screw and the crane arm. For the shallow holes which are required for street-lighting posts this machine has proved to be remarkably efficient. With it two men have dug 105 holes in eight hours and the machine is reported as using during that time 5 gal. of gasoline and 1 qt. of lubricating oil.

The use of a trenching machine in installing the cable was described in a previous issue.

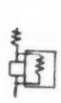


The versatile Fordson tractor enters the hole-digging field

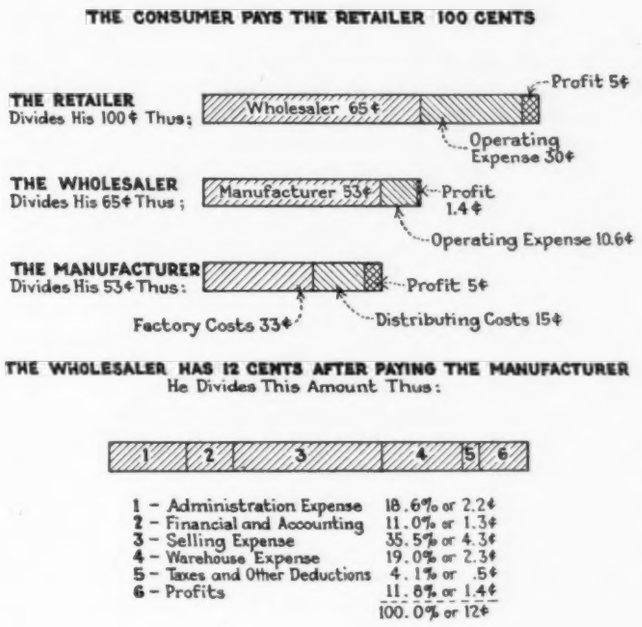
Suggested Symbols for Power Apparatus

Tentative forms suggested by American Standards Association subcommittee, pending receipt of opinions, criticisms and suggestions

Name	One Line	Complete
Disconnecting Switch—Basic Symbol		
Knife Switch, Single-Throw		
Disconnecting Switch, Group Operated		
Air Break Switch, Horn Gap, Group Operated		
Double-Throw Switch		
Oil Circuit Breaker, Single-Throw		
Oil Circuit Breaker, Double-Throw		
Air Circuit Breaker		
Fuse		
Rheostat		
Reactor		
Static Condenser		
Lightning Arrester—Basic Symbol		
Electrolytic or Aluminum Cell Lightning Arrester		
Valve or Film Lightning Arrester		
Multigap Lightning Arrester		
Horn Gap Lightning Arrester		
Pothead Cable Terminal		
Mercury Rectifier		

Name	One Line	Complete
A-C. Generator or Motor—Basic Symbol For motor, use "M" within symbol if necessary to distinguish		
Induction Motor		
Induction Motor with Slip Ring Rotor		
Synchronous Generator or Motor with Separately Excited Field		
Synchronous Converter (See also "D-C. Generator or Motor")		
D-C. Generator or Motor—Basic Symbol For motor, use "M" within symbol if necessary to distinguish		
D-C. Generator or Motor with Shunt and Series Field		
Direct Connected Units—Basic Symbol Use particular symbols and join as here shown		
Single-Phase Two-Winding Transformer—Basic Symbol		
Polyphase Two-Winding Transformer—Basic Symbol		
Three-Winding Transformer		
Auto-Transformer		
Transformer with Taps		
Constant Current Transformer		
Current Transformer		
Potential Transformer		
Induction Voltage Regulator		

A Word for the Jobber



By JOHN J. GIBSON

Vice-President Westinghouse Electric Supply Company

IN THE electrical business "jobber" means wholesaler, the only middle man, the only man between the manufacturer and the retailer that we know in our business. The functions of the electrical wholesaler are not generally understood, and for that reason in the hue and cry against the high cost of distribution he has been criticised. Such criticism cannot take the form of accusing the wholesaler of being responsible for any part of the extravagance which has caused our high cost of distribution, for his is the one and only step in the distribution chain which is economical. He has to be economical. He cannot do otherwise on the small margin which remains to him between the cost of his merchandise and the price at which he can sell in a market where the mad scramble for volume on the part of the manufacturers takes all control of resale price away from him, and in a market where also the retailer, obliged to give such super service to the consumer, finds economy impossible.

We have witnessed two great movements in this country in the last quarter century. One has brought about the greatly decreased costs of mechanized and mass production and the other, a natural consequence, has caused a greatly augmented sales effort necessary to distribute this greater production. Fortunately, we have also witnessed a gradual increase in wages that has made possible the absorption of this greater production, but unfortunately, on the other hand, we have seen high-pressure sales methods eat up most of the savings of mass production.

Throughout this development the wholesaler has been called upon to perform greater and more extensive services to both the manufacturer and the retailer with greater and greater "tonnage" to handle per dollar of business and with a constantly narrowing margin of gross profit within which to operate. The accompanying chart illustrates a typical case and shows a division of the consumer's dollar spent for electrical merchandise. It is not the purpose of this article to discuss other than the wholesaler's function, in the chain of distribution, for which, it will be noted, he retains the munificent sum of 1.4 cents out of each dollar of the purchase price, after expending 10.6 cents in cost of his services.

The wholesaler has many functions

This analysis illustrates the striking fact that the wholesaler operates on the smallest portion of the consumer's dollar, smaller than is required by any other step in the chain of distribution. And what service does he perform for this 12-cent wage? The wholesaler serves both the manufacturer and the dealer. For the former he provides a local warehouse and a local sales force. He gives the manufacturer the benefit of his first-hand knowledge of local demand. The cost of duplicating these two services alone would be prohibitive for any single manufacturer.

In addition the wholesaler effects savings in transportation; he affords an element of stabilization of production; he provides local credit and collection responsibilities and makes possible to the manufacturer a distinct saving in capital which would otherwise have to be invested in merchandise for receivables.

For the dealer he is an aggregator. He carries in stock thousands of items of merchandise on which the retailer may draw at will, and at once, thus allowing the retailer to operate with a lower inventory and a more rapid turnover. The wholesaler's catalog makes the selection of goods and the ordering of them easy. The wholesaler often finances the dealer through the extension of credit and arrangement of accommodating terms of payment.

The wholesaler further guides and helps dealers with good business advice, which he can give with less bias than a manufacturer's representative, because the wholesaler is not limited to a narrow field. That is why the

wholesaler is often called the purchasing agent of his community.

Because of the many and diversified lines handled, the wholesale salesman can afford to visit more towns and the dealers in them more frequently. His costs are spread over a much broader stream of trade than would be possible to an individual manufacturer. Financially, too, the least important electrical wholesalers have invested in goods carried in stock from $25,000 to $50,000 and from this low to several hundred thousand for the larger houses.

Risk must be taken care of

Commercial risk constitutes one of the highest items in the cost of conducting a mercantile business. Losses on bad debts and shrinkage of merchandise inventory normally run from 1 per cent to 2 per cent and at times are considerably higher. These losses would be borne by the manufacturer if the wholesaler were not there to absorb them.

It is obvious that to operate within this restricted margin, over such a wide line of products, the wholesaler cannot be expected to act as a specialty salesman or to push certain special lines in the manner often expected by manufacturers using "high-pressure" salesmen. This would not only be impossible but it would mitigate against the best service the wholesaler is in a position to perform for the retailer.

These special selling efforts can be performed only in two ways—by the manufacturer, and as a part of his sales expense directed in support of the direct selling of the wholesaler, or by the wholesaler, on a greater margin allowance from the manufacturer to be spent in advertising and promotion work. It can hardly be expected that the manufacturers, especially the large ones, will relinquish the control of their product sales. Their investment in plant and production machinery is too great to make this economically sound, and economically the control must lie with the greater investment.

There is much, however, that can be done in the better promotion of sales through wholesale channels, but it can be accomplished only through a sympathetic understanding of their mutual problems on the part of each of the two factors, the manufacturer and the wholesaler. Offense might be given if the faults of each were pointed out in this article. They are well known. The problem is a specific one requiring individual analysis of conditions.

Where a manufacturer feels that his wholesaler is not giving him the support and the distribution he feels he should receive, let him indulge in a little self-analysis as to his products, his own service and the compensation he provides for his wholesaler. Let him bear in mind that a wholesaler cannot devote more time and attention to his line of products than is actually justified by the manufacturer's product and service and compensation. On the other hand, when a wholesaler feels that a manufacturer is not treating him in the right way, let him also turn the searchlight on his own organization and determine whether he is honest with the manufacturer and with himself and whether he is not inefficient in his operations and using bad judgment. Best of all, let them both sit down together and go over their individual case in the proper spirit, and then, indeed, much would be done for the better promotion of sales through wholesale channels.

▼ ▼ ▼

Turbine and Generator Overhaul Reveals Peculiar Troubles

By M. M. McINTIRE

Electrical Engineer Imperial Irrigation District, Imperial, Calif.

THE overhaul of the three 5,000-kva. hydro-electric units at the Don Pedro plant of the Turlock and Modesto (California) irrigation districts brought to light some interesting conditions and developed methods of repair which may prove of interest to other operating engineers faced with similar problems. These vertical shaft units were placed in operation in 1923 and ran practically continuously until 1928, when two new units were installed which permitted the old machines to be taken out of service, one at a time, for a thorough inspection and overhaul.

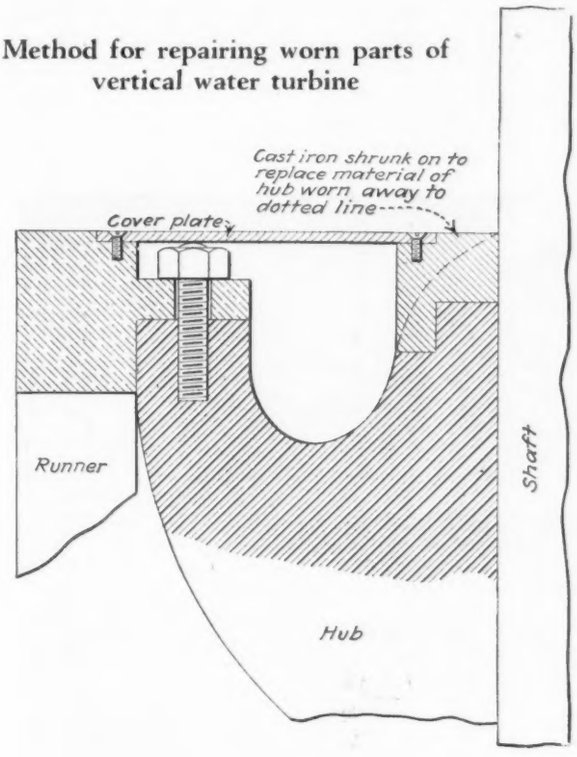
All three units were found to be out of line to about the same extent, either due to expansion of the generator floor away from the rock wall against which the power house was built, or due to errors in original installation. This misalignment, which amounted to about $\frac{3}{16}$ in. horizontally, was corrected by moving the stator on the bed ring. There was sufficient clearance in most of the hold-down bolt holes to permit this motion, but some had to be chipped a little. New dowel holes were drilled and the adjustable lower guide bearing bracket was moved to allow for the correction. The correction in misalignment removed a great deal of vibration which had been noticed, especially in No. 3 unit.

All the machines had been at various times during the five-year period subjected to oil floods from overflowing guide bearings. In addition to these floods there had been a continuous depositing of oil vapor condensate from these same bearings. Combining with the dust which had been drawn through the machine with the cooling air, this oil had formed a thick coating of oily mud over the windings and in the ventilating ducts. In order to clear these out a scraper fashioned to fit a section of the duct was forced through every duct in the machine. To remove the deposit from the windings a mixture of 50 per cent carbon-tetrachloride and 50 per cent gasoline was used in an air paint gun to loosen up the mud. The deposit was then scraped off with wooden scrapers and the whole machine cleaned with an air blast. Following this the windings were sprayed with two coats of insulating varnish. Aside from this condition the generators were in good shape.

It was known before the overhaul started that the

turbine runners were badly pitted and new runners were on hand. On the No. 3 unit, which was the first one overhauled, the disassembly was accomplished without difficulty and the old runners found to be in about the condition anticipated. Holes an inch in diameter were eaten through some of the blades. When it was attempted to install the new runners, however, it was found that the seal ring was out of round and that the runner would not fit. This condition apparently was due to a warping of the cast-steel turbine casing when it was set in the concrete. The condition was corrected by means of an air grinder and the machine reassembled.

Method for repairing worn parts of vertical water turbine



Cover plate bolts destroyed

Upon disassembling No. 2 unit no difficulty was encountered until the turbine was uncoupled from the generator, when, without warning, the shaft dropped about 3 ft., being stopped by a lower coupling striking the top of the lignum-vitæ bearing on the turbine. Upon investigation it was found that oxidizing action in the turbine had completely destroyed the bolts holding the cover plate on top of the rotor and the plate had threshed itself to pieces, wearing away the nuts and the top of the studs which held the rotor onto the hub of the shaft. Since the runner on this type of turbine is installed by dropping down over the shaft onto the hub it could not fall off, but had been loose on the shaft for a long time and had been driving the generator by means of these studs acting as pins only. When uncoupled from above, the shaft merely dropped through the runner. A similar condition was found in No. 1 unit, but the previous experience acquired led us to block up under the shaft before uncoupling it.

On both No. 2 and No. 1 units the portion of the hub at the top and next to the shaft was so badly worn by the action of the loose cover plates that the worn-away portion had to be replaced before the new runner could be put on. The turbine shaft with the hub in place was put in a lathe and the worn portion trimmed up, as shown below the dotted lines in the accompanying sketch.

A cast-iron ring was then made, machined and shrunk into place on the hub as shown. In addition to the shrinking, pins were installed running from the new ring into the old material. When the new cover plates were installed the slots in the screws and all other inequalities around the screw holes were filled up with solder and smoothed off so as to furnish no places for oxidizing action to start.

During the reassembly of the machines felt washers were installed between the rotating covers of the oil pans and the pans themselves both at the upper and lower guide bearings. It is expected that this will, to a large extent, cut off the leakage of oil vapor which had been so annoying.

Before the machines were put back into service the Woodward governors were completely overhauled and worn parts replaced where necessary. For some time previous to the overhaul the governors were very sluggish. This was found to be caused by the fact that the wedge-shaped ball race in the governor head was so badly worn that no vibratory motion was being transmitted to the pilot valve. These particular governors were so designed that this condition could be corrected by turning the ball race over, presenting a new surface for the ball bearings to run on.

To complete the overhaul a special d.c. grinder was mounted on the top of the exciter frame and with the machine turning over at about one-quarter speed the slip rings were ground smooth and true, care being taken that none of this ground-off material got into the windings and bearings. A new set of brushes was installed and the machines placed in service.

No Longer "Light Companies"

By K. R. MACKINNON
Nebraska Power Company

WE MUST create an electrical atmosphere —an electrical consciousness among our customers so that they can say, "Electricity is cheap—we are going to use a lot of it," and it must be made possible for them to use all they can at a reasonable cost. But in so doing it the idea must be sold that they are paying us money that formerly went to others—including the doctor—and that the bill is *not* a *light bill!*

We still think of ourselves and call ourselves light companies. We are in a much bigger business than simply selling light. Today we are replacing many items of expense in the home by doing things electrically which have been done by other means, and yet we still think of our bills as *light* bills and call them such.

Electric Coal Handling Saves in Industrial Plant

ALTHOUGH installed some years ago, the coal-handling system at the Arlington, N. J., plant of the Du Pont Viscoloid Company, Inc., continues to show notable economies. An electrically operated, fixed-base, rotary crane with two guying supports and 65-ft. horizontal boom has been used for the unloading of steel gondola cars, coal storage and feeding to small car conveyors for the pulverized fuel burner unit mills. Driven by a single 30-hp. motor, which rotates the crane and operates the bucket hoist, and serving a 10,000-ton storage bin, this Main Electric Company crane has consistently held coverage coal-handling charges to about 8 cents per ton.

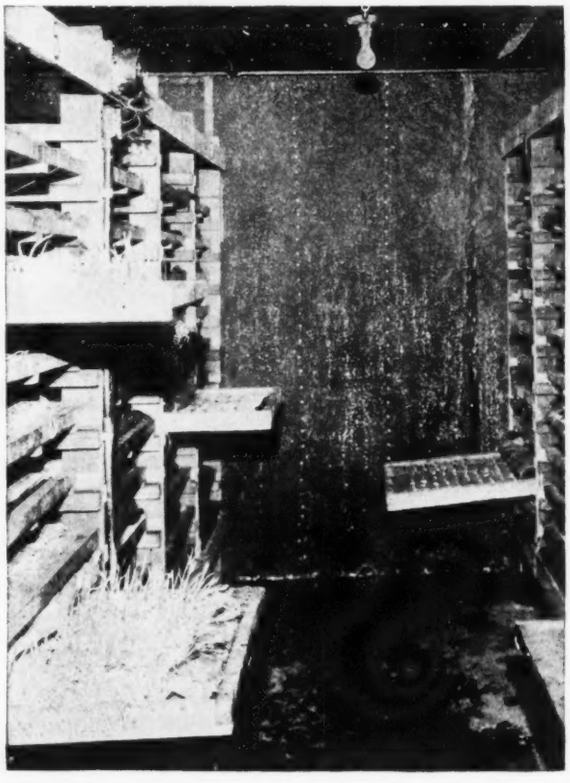
One of the elements contributing to the ease of operation of this system is the freedom from any necessity for car shifting by hand. Four standard gondola cars can be accommodated on the track by the side of the crane and emptied to storage of feeding bin through the activities of the single crane operator without any shifting of their positions.

▼ ▼ ▼

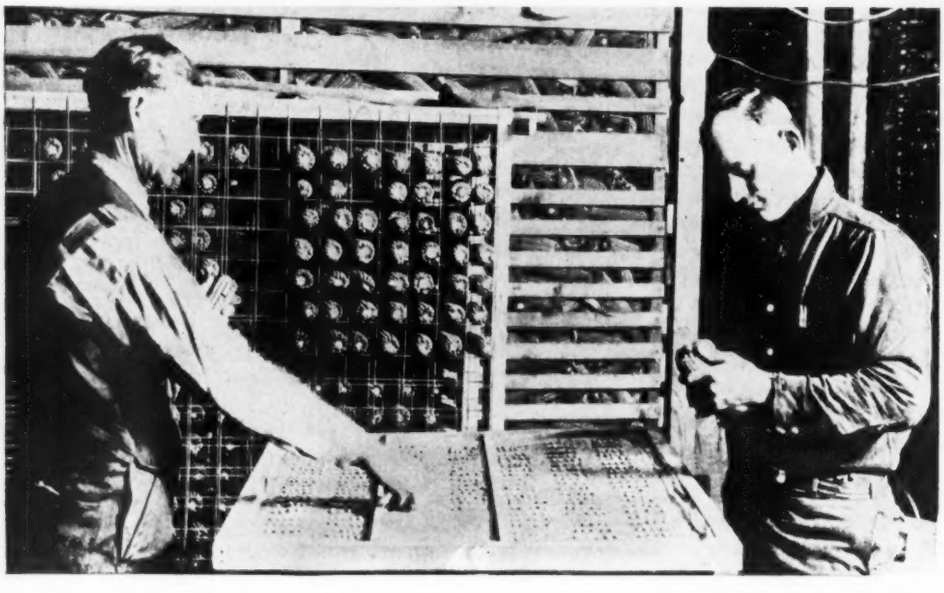
Seed Corn Testing Improved by Electric Heat

IT IS very important, in the raising of good-quality corn and at the same time to get good production per acre, that the seed corn be carefully selected. Corn is selected on two points, one being percentage germination and the other the absence of harmful diseases. The electrically operated seed corn tester maintains a uniform temperature and makes it possible to fulfill humidity requirements which will bring out diseases. It is for this reason that the electric has proved more popular than any other type of tester previously used.

Six farmers near Chicago use an electrically heated seed corn germinator during four or five winter months. Heat is supplied by electric strip heaters rated at 5 kw., controlled by an electric thermostat. The capacity is 100 bush. per week. The farmers give the equipment credit for an increase varying from 9 to 15 bush. per acre in their production, as well as paying for all costs through sales of high-grade seed corn to other farmers. The equipment used in the Chicago tests has been developed experimentally in collaboration with General Electric Company engineers.



Inside the germinator; thermostat in upper left



Marking and filing sample of corn germinated by electric heat

READERS' FORUM

Defends Series Street Lighting

To the Editor of the ELECTRICAL WORLD:

Long experience with both series and multiple street-lighting service leads to the suggestion that the comments made by Mr. Hood, commencing on page 900 of the May 3, 1930, issue of the ELECTRICAL WORLD, cannot be taken as a correct presentation of the questions at issue. It seems proper to suggest that with the exception of those few companies still employing Brush generators for the operation of series circuits there is no known system of series street lighting which involves losses of 25 per cent and upward from the substation to the lamps.

Street-lighting service supplied from constant-current transformers, or from rectifiers where magnetite lamps are used, involves losses from substation to lamp not exceeding 10 per cent. In a large system which utilizes constant-current transformers to supply a large series street-lighting load individual circuit efficiencies from substation to lamps reach 95 per cent. Variations in losses are largely dependent upon the length of circuit, size of conductors and types of lamp equipment operated.

In comparing the efficiencies of series versus multiple systems it does not appear that multiple systems of distribution in general can equal the efficiency of a series street-lighting system operated from constant-current transformers. At least it is only in the case of a few of the newer network systems that efficiencies of 90 per cent from substation to consumer are reached. Any general statement which seeks to compare systems should include consideration of these factors.

Operating costs, likewise, do not conform to the statements of the author, since voluminous records of the comparative cost of series versus multiple street-lighting service indicate that under identical conditions the series system is the more efficient and least costly to operate.

Statements regarding the initial cost of plant for street-lighting service cannot be made without qualifications to cover the varying conditions under which such construction is carried out in our various utility systems. If a comparison is made between an all overhead system and an underground installation, it must follow that the overhead system will involve the lowest cost.

In a similar manner the type of system installed involves varying costs of a large order. To omit stating these variables is fatal to any statement concerning comparative costs. Comparisons should specify whether they are directed at service supplied in city versus country areas, with due regard to the types of construction permitted.

Conduit construction under heavily surfaced streets certainly involves higher costs than if under macadam. Cables installed in conduit may not be compared on the same basis with parkway cable installed in a simple trench or along streets in country areas.

Real estate for housing converting apparatus varies widely in different localities, as do the fixed charges required to be allowed on all construction employed for this service.

Operating costs are likewise subject to wide variations, those costs being affected by the cost of energy, labor and maintenance of lines and equipment.

Company policies which vary widely with respect to treatment of employees, involving allowances for vacation, illness, pensions, etc., all are contributing factors to variable final operating costs.

Diversity is suggested as favorable to the operation of street lighting from multiple systems, but apparently consideration has not been given to the fact that in our northern states, at least, the demands of both classes of service coincide, hence full capacity must be provided for street lighting in such areas.

Reference is made to gross duplication of wire, plant and the use of innumerable "safety gadgets" with series systems. Viewing series systems as operated, their simplicity appeals to one's judgment as being a type of installation of the simplest character, certainly much simpler and more easily controlled than the equipment required for a multiple system of distribution.

In stating that series lamps deliver 10 per cent more lighting at an expense of 25 per cent increased energy, it does not appear that this statement can be justified by the facts. The situation can best perhaps be summed up by stating certain facts which are based upon experience in one typical combination city and suburban area involving supply for over 30,000 lamps of various types.

Series street-lighting installations are installed and operated at substantially less cost than are multiple lighting units. The operating efficiency of the series system is in all cases higher than the multiple system.

Operating costs of the two systems, using identical lamp units, are in favor of the series system. The lighting values supplied by either system may be made identical with the more recent lamp products.

Manufacturers of series lighting equipment should be praised rather than condemned for the work which they have and are still doing to provide street-lighting equipment of the most efficient character. Without the series system, street-lighting service throughout the country could never have reached its present standardized basis or have made possible the supply of this service on an economical basis if it had not been for the co-operation of manufacturers.

Users have at all times had a choice of a substantial number of systems which are adapted to meet almost any conceivable service conditions, and to suggest that manufacturers have perpetrated an injustice upon the industry in continuing to produce the series street-lighting equipment is farthest from the facts. Series street lighting is in fact the only system which can be economically utilized in country districts, where in these days of automobile travel street lighting is a material factor in promoting travel safety.

Decisions which have been reached in various cities as mentioned by the author have all undoubtedly been based upon some fundamental factors which have justified the adoption of different types of systems in these different locations; in fact, it is impossible to believe otherwise.

Criticism of any street-lighting system which is unsupported by facts is misleading and detrimental to all affected interests.

L. L. ELDEN,
Technical Adviser to the General Superintendent.
Edison Electric Illuminating Company of Boston.

BOOK REVIEWS

Electric Wiring

By Albert A. Schuhler. New York: McGraw-Hill Book Company, Inc. 380 pages. Price, $2.50.

This book is an excellent guide for electrical workers, either in design or construction work. For reference purposes the diagrams on bell, annunciator and house wiring alone are more valuable than the price of the book. A few suggestions are made on electrical construction which experience shows might be changed to advantage, e.g., the "Britannia Splice." The wrapped cable splice is in general used, and if properly made will not pull off. But the core or inner layers of one conductor should be cut out or the joint will be too large.

Better and faster work can be accomplished on large cables by using a plumbers' furnace with two ladles or, better still, an electric solder pot, instead of a blowtorch. An open flame is prohibited in some cases, but the electric furnace, with necessary precautions, can be used on jobs where gases exist.

Discussing tape, the author fails to mention asbestos, which is used extensively as a protection to the insulation of conductor that is being soldered. Rubber tape is not generally used, except by house wiremen or on some special jobs. Empire tape or treated cloth makes an excellent tape for all voltages over 110.

Some of the fixture connectors shown are a source of trouble, while others are very good, and coming into use more every day. The author fails to mention a hard-rubber casing available for insulating these fittings.

▼

La Décharge Electríque Dans Le Vide et Dans Les Gaz

By Maurice Leblanc and Maurice Leblanc fils. Paris: Ballière et fils, 1929.

This book was started by the noted Maurice Leblanc, the only engineer member of the French Academy, and after his death was completed by his son. M. Leblanc, Sr., is very well known to engineers working on electric discharges, and particularly on mercury-arc rectifiers. He succeeded in proving a number of his ideas, but remained a scientist almost too advanced for his time.

A fundamental mathematical treatise on the subject, the first part begins with the fundamental theories concerning motion of particles, kinetic gas theory, motion of electrified particles in the electric and magnet field; atomic constitution of electricity, experiments by Crookes, Perrin, J. J. Thompson, Millikan; electron theory, Bohr theory; ions in gases, absorption of radiations by atoms and critical potentials of the molecules.

The second part involves passage of electricity through vacuum—definition of vacuum, photo-electricity, emission of positive ions by heated conductors, influence of electric field, saturation current, apparatus using electron emission in vacuum; passage of electricity through gases when the cathode remains cold and when the cathode is hot—characteristics of the discharge, case of alternating current, theory of direct-current arc, low potential arcs.

The third part covers apparatus using electron discharge in vacuum, apparatus using electric discharge in rarefied gas, gas-filled X-Ray tubes, electric valves, photo-electric cells, cathods-ray oscillographs, positive electric rays, electric arc as a rectifier and arcing in electric machinery.

The volume offers good mathematical presentation of the fundamental phenomena connected with electric discharges; it may be considered incomplete, but it is hardly possible to present a subject so vast in 370 pages; it may be very useful for research engineers.

▼

Worked Examples in Electrical Technology

By F. Peasgood and H. J. Boyland. England: Oxford University Press. 219 pages, illustrated. Price, $5.

This book comprises a series of examples in electrical engineering. Each problem is stated clearly and the solution is then shown. At the end of each topic thus treated examples and questions are given for the use of students. The direct-current circuit, magnetic circuit and alternating-current circuit are the main divisions and problems in each division are devised to develop the major principles and provide applications. The book is well done and covers the scope outlined splendidly. It should be useful as a supplementary text for electrical students.

▼

Arbeiten aus dem Electrotechnischen Institute

Der Badischen Technischen Hochschule Friedericiana zu Karlsruhe. (Publications of the Institute of Electrical Engineers, Karlsruhe Institute of Technology, Baden, Germany.) Published by Prof. Dr. R. Richter, Director of the Institute. Volume V, 1927-1929. J. Springer, 1930.

Dr. E. Arnold, the first director of the Karlsruhe Institute of Electrical Engineering, discontinued the publication of papers submitted by graduated engineers as doctor's degree theses during the war, but continues again in this volume. Three theses are included:

1. By H. Weissheimer on "End Leakage of the Synchronous Machine," presenting experimental and mathematical determinations of end leakage with various windings.

2. By E. Stumpp on "Heating of the Axially Ventilated Turbo-Generators," in which consideration is given the heat conductivity perpendicular to punchings and the effect of temperature on the electrical conductivity of the winding metal, but both these effects can be disregarded.

3. By J. Reiser on "Determination of the Impact Short Circuit in Turbo-Generators with Damping Winding," in which are considered the actual distribution of damping windings, the conductors of which are placed in the same slots with the excitation winding. His calculations seem to be in good accord with the experimental results. In comparison with the previous theory, the impact short-circuit currents appear to be bigger in the armature and smaller in the excitation winding.

The volume is of interest to design engineers.

Men of the Industry

Wiley F. Corl Becomes U.G.I. Vice-President

WILEY F. CORL has been elected a vice-president of the United Gas Improvement Company, according to an announcement make by John E. Zimmermann, president of the company. Mr. Corl, who is president of Common-

wealth Utilities Corporation, became associated with U.G.I. late last year when U.G.I. acquired a controlling interest in that company, whose subsidiaries operate in 53 communities in Ohio, Arizona, Kentucky, Missouri, Oklahoma, Kansas and Texas. He was born in Missouri and was graduated from the University of Missouri in electrical engineering in 1908.

After graduation he was engaged in engineering and construction work for several years. In 1913 he joined the Southern Illinois Light & Power Company, first as general superintendent and later as vice-president, and in 1918 he acquired an interest in the Missouri Utilities Company, Mexico, Mo., later becoming president of the Community Power & Light Company, a holding company, which has subsidiaries operating in Kansas, Arkansas, Missouri, Texas and New Mexico. In 1925 he resigned the presidency of Community Power & Light Company and organized the Commonwealth Utilities Corporation.

Mr. Corl is a pioneer in the extension of transmission lines to small communities and in the centralization of power production facilities in such communities. He is a director of the First National Bank, St. Louis, Mo., and of the Second Investors Corporation, Providence, R. I.

▼

Westinghouse Elects Three Vice-Presidents

THREE NEW EXECUTIVE POSITIONS, the office of commercial vice-president, have been created by the board of directors of the Westinghouse Electric & Manufacturing Company, President F. A. Merrick announces. C. E. Stephens was selected to occupy the new position for the Atlantic division with headquarters at New York City, N. G. Symonds for the Central division in Chicago and W. R. Marshall for the Pacific division at San Francisco. All of the new commercial vice-presidents have been district managers and will continue their duties in that capacity in addition to those of the new position. The commercial vice-presidents will report to Vice-President W. S. Rugg, who is in charge of sales and engineering. They will be his representatives in the general supervision of field activities and in the advancing of the commercial interests of the company.

▼

PAUL A. SCHOELLKOPF, president of the Niagara Hudson Power Corporation, returned to New York June 3 aboard the French liner *Ile de France* after a short trip abroad.

•

SAMUEL INSULL, chairman of the board of directors of the Commonwealth Edison Company, sailed for Europe June 6 aboard the *Ile de France*. Mr. Insull will attend the sessions of the World Power Conference meeting in Berlin June 17-26.

•

EDWARD DEAN ADAMS, engineer, was made the recipient of the honorary degree of doctor of science by Columbia University at the annual commencement exercises held June 3. The citation said: "Engineer and man of affairs . . . following through a long and busy life an honorable career of business activity and public service; keenly interested in engineering and in the new aplications of scientific knowledge to the needs of man; honored both at home and abroad for personal service and generous benefactions to advance those fields of scientific knowledge in which his interest has long been so keen and his co-operation so helpful.

•

H. T. BUSSMANN of the Bussmann Manufacturing Company has been elected president of the St. Louis (Mo.) Electrical Board of Trade.

•

GIUSEPPE FACCIOLI, whose retirement from active participation in the engineering work which made him widely known was announced in the June 7 issue of ELECTRICAL WORLD, was born in Milan, Italy, and came to this country more than 25 years ago. He first became employed by the New York Edison Company, later by the Interborough Rapid Transit Company and subsequently by the Crocker Wheeler Company. It was at this time that he met William Stanley, then

wrestling with his new alternating-current generator. Mr. Faccioli performed a feat of mathematics which amazed all of the engineers who knew of it, comprising the figuring to the precise amount the amperage which a given machine would deliver, whereas anywhere within 10 per cent would have been considered remarkable. In 1908 he became identified with the Pittsfield works of the General Electric Company, where his mathematical genius proved unusually valuable in all

problems pertaining to the products of that plant, mainly transformers. Mr. Faccioli also spent considerable time at Schenectady, where he was associated with the late Dr. Charles P. Steinmetz, whose researches in the field of lightning became famous. These studies were continued at Pittsfield by Mr. Faccioli and they contributed in no small measure to the success of the now famous high-voltage laboratory. As a member of the general standardizing committee of the General Electric Company he contributed his talents to an important department of company activity. As announced in last week's issue, Mr. Faccioli assumes the position of consulting engineer for the General Electric Company.

▼

A. D. Robb Named President of Niagara Utility

ALEXANDER D. ROBB, formerly executive vice-president of the Niagara Electric Service Corporation at Niagara Falls, N. Y., has been elected president of that company. Mr. Robb is also vice-president of the Buffalo, Niagara & Eastern Power Corporation, vice-president of the Niagara Falls Power Company, and was recently elected president and general manager of the Niagara Junction Railway Company. He has been connected with the hydro-electric development of the Niagara frontier since 1901, and during that time has held many important positions.

Starting with the Canadian Niagara Power Company, he served successively as mechanical inspector, assistant superintendent and superintendent. In 1921 he was appointed assistant to the president of the Niagara Falls Power Company and in 1925 was made vice-president. He was also elected vice-president of the Niagara Gorge Railroad Company, and is now vice-president and general manager. He is vice-president of the Niagara Gray Bus Line, as well as vice-president, secretary and assistant general manager of the Canadian Niagara Power Company. Mr. Robb is a director of the Canadian Niagara Power Company, Niagara Gorge Railroad Company, Niagara Gray Bus Line, Gluck Realty Company and of the Niagara Electric Service Corporation.

▼

LOUIS KAHLENBERG, professor of chemistry at the University of Wisconsin, has just been elected president of the American Electrochemical Society.

•

SIR WILLIAM H. BRAGG, director of the Royal Institution of Great Britain and of the David Faraday Research Laboratory, received the Franklin gold medal of the Franklin Institute May 21 in recognition of his studies in atomic and molecular structures.

•

JAMES C. KENNEDY has been elected president of the American Public Service Company, Dallas, Tex., succeeding Martin J. Insull, who becomes vice-chairman. Mr. Kennedy has been active in the public utility industry in the Southwest for a number of years. At the present time he is also president of the Central & South West Utilities Company. PRICE CAMPBELL, president of the West Texas Utilities Company, has been elected vice-president and a director of the American Public Service Company and the Central & South West Utilities Company.

▼

OBITUARY

Dr. W. S. Franklin

DR. WILLIAM S. FRANKLIN, well-known educator, died June 6 as the result of injuries sustained in an automobile accident. Dr. Franklin was driving north from Florida, where he had spent the winter, when the accident occurred at Wilmington, N. C. He was born in Geary City, Kan., 67 years ago and was educated at the University of Kansas, University of Berlin, Harvard and at Cornell. From 1887, when he joined the staff of the University of Kansas as assistant professor of physics, he had devoted special attention to this branch of science, also teaching electrical engineering at Iowa State College from 1892 to 1897 and at Lehigh University from 1897 to 1903. For twelve years he occupied the chair of physics at Lehigh and then in 1917 he was called to the Massachusetts Institute of Technology as lecturer in physics, being made full professor of that subject in 1919. Last fall he resigned to go to Florida upon the request of President Holt of Rollins College at Winter Park, where he accepted the visiting professorship in physics. Outside academic circles Dr. Franklin was widely known as the author of numerous papers on scientific subjects and of textbooks in the allied fields of electricity and physics. He was a fellow of the American Association for the Advancement of Science and was active in other technical societies, including the Society for the Promotion of Engineering Education and the American Physical Society.

▼

WILLIAM G. GORDON, prominent in engineering circles in Toronto, Canada, died May 13, following a short illness. A graduate of Cornell University, Mr. Gordon was first employed in the Schenectady Works of the General Electric Company in the testing and construction department and subsequently was transferred to the general offices. When he removed to Canada he became identified with the Canadian General Electric Company. Mr. Gordon was president of the Engineers' Club in Toronto.

•

DANE SINCLAIR, chairman of the British Insulated Cables, Ltd., and a director of various British cable construction, telephone and electric supply companies, died at Weybridge, England, on May 6, at the age of 78. His early years were spent on the staff of the telegraph department of the North British Railway and subsequently in the service of the Japanese government as inspector of telegraphs. On returning to his own country Mr. Sinclair became engineer to the National Telephone Company in the Glasgow district, and under his advice the three principal telephone companies then operating in Great Britain were amalgamated into one large organization, of which he became engineer-in-chief.

•

JAMES M. MCCARTHY of Quebec, vice-president of Price Brothers & Company, Ltd., died May 22, after a lengthy illness, at the age of 66. He was born at Sorel, Que., and was graduated from McGill University. The earlier part of his career was spent in New York, where he obtained considerable prominence in his profession, becoming president of the American Light & Traction Company, and holding other executive positions. Later Mr. McCarthy returned to Canada and became identified with the public utility industry in that country. Twenty years ago Mr. McCarthy became an officer of Price Brothers & Company, retaining that position until his death.

Financial and Statistical News

HEAVY accumulation of American stocks on the part of European buyers continues. Utility common stocks are a favored group and European holdings are estimated to be unusually large at present. New utility flotations exceeded $70,000,000 this week. The bulk of this was in the form of short-term notes.

——UTILITY BOND ISSUES CONTINUE FIRM, but trading has not been especially active this week.

▼ ▼ ▼

NEW CAPITAL ISSUES

During the week ended June 12 public utility financing was extremely active, several large issues being offered the investing public. A fifty-million-dollar offering was made by the Middle West Utilities Company in the form of short-term convertible notes.

•

New England Public Service Company issued 60,000 shares of prior lien preferred stock at 91½ and accrued dividend, to yield about 6.55 per cent. Proceeds of this financing are to be used to increase the company's investment in the junior securities of its operating utility subsidiaries, to retire short-time debt, and for other corporate purposes.

•

Another substantial issue of preferred stock appeared among the new offerings. Electric Power & Light Corporation issued 100,000 shares of cumulative $6 preferred stock, the price being $100.50 a share and accrued dividend from July 1, 1930, to yield over 5.95 per cent. Proceeds from the sale of this cumulative preferred stock will be used for general corporate purposes.

•

Central Power & Light Company offered an additional issue of first mortgage 5 per cent gold bonds priced at 95 and accrued interest to yield about 5.35 per cent, a piece of financing involving a total of $5,500,000. The company is part of the Middle West Utilities system.

▼

Canada Output Gains in April

A SHARP GAIN IN THE OUTPUT of electric energy by the central electric stations of Canada is noted for the month of April. The average daily hydro-electric output was 54,131,000 kw.-hr., as compared with 47,859,000 kw.-hr. in March, a gain after seasonal adjustment of no less than 13 per cent. The comparison with April of last year, presenting an increase of nearly 18 per cent, throws into relief the rapid growth of the power industry in Canada during the past year.

▼

Greek Electric Plants Use Diesels

ALMOST ALL OF THE 219 electric light and power plants in Greece are operated by means of Diesel engines, according to circular No. 586 of the Bureau of Foreign and Domestic Commerce, recently issued, on central light and power plants in Greece. The total prime mover rating is 87,418 hp. and the generator rating 65,599 kw. Only 77 plants have a rating of 100 hp. or larger, while but six of this number exceed 1,000 hp. The only fairly large plant, judged by American standards, is that at Athens, with 33,750 kw. It is steam driven. About half the plants supply direct current, some at 110 volts, others at 220 and a few at 110-220 volts, three wire. One case of 150-300 volts is noted. The alternating-current systems, including that serving Athens and vicinity, are operated at 50 cycles, three phase, with a few exceptions. The predominating voltages are 127-220 and 220-380. Only three plants are operated on water power: One of 4,220 hp., one of 412 hp. and one of 193 hp. A few small plants with mixed drive are also operated partly on water power.

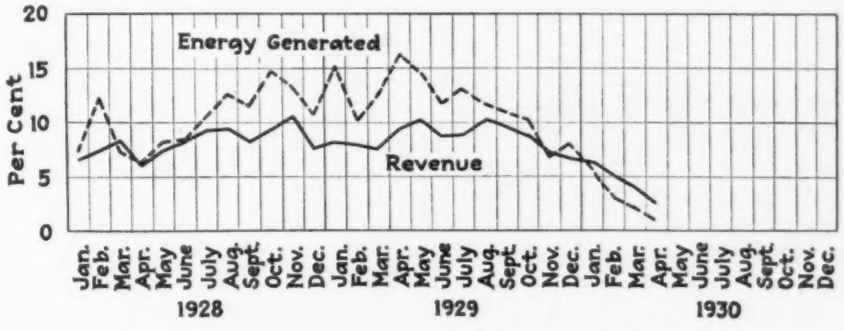
▼

April Output Shows Improvement

A DEFINITE UPWARD SWING in industrial activity is indicated in the U. S. Geological Survey report on energy generated by public utility plants in April. The output is given as 7,960,223,000 kw.-hr., exceeding last year's corresponding amount by 1 per cent.

After a gain in March of 2 per cent the April showing at first glance looks like a recession. The contrary is true. A proper perspective has to take into account what happened in 1929. In that year the March output of all public utility plants was 10 per cent more than in 1928; in April it rose to 15 per cent, the maximum for any month in 1929. It is this spring peak of an unusual year that has now been surpassed.

The Survey report points out that "the change from March to April in the daily production of electricity shown by the records for the last ten years has been a reduction, ranging from 2 to 9 per cent and averaging nearly 6 per cent. As the daily output for April of this year was about 1 per cent greater than that for March, it may be considered that there was a marked increase in the demand for electricity in April, which was sufficient to more than counteract the usual seasonal decrease."


Energy Generated
Revenue
Per Cent
20
15
10
5
0
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1928
1929
1930

Gain over 1929 continues despite last year's spring peak

Each month shows excess in revenue and output over corresponding month of previous year.

Public Takes to Utility Securities

By WILLIAM J. CRAWFORD
H. C. Yeager & Company, Inc.

IT WOULD be interesting to know just how many investors' safe-deposit boxes contain public utility securities. Probably it would be easier to guess that those without constitute a small percentage of the whole, for public utility securities have met with a whole-hearted acceptance by the public and have continued as a favorable choice for the employment of idle funds.

Why do experienced investors show such a preference for securities of this class? Perhaps this question can be answered by citing a few current statistics.

Exports during the year ended March 31 decreased 23.7 per cent, cotton consumption decreased 9.5 per cent, railroad net earnings decreased 22.4 per cent, while public utility gross earnings increased 2.88 per cent and net earnings increased 4.07 per cent. In periods when other industries were suffering from subnormal business, the public utility industry convinced investors of its basic soundness and its ability to withstand periods of depression.

The growth of the electric power and light industry has been phenomenal. In the last seven years this business has doubled in volume. Since 1915 the amount of electrical energy generated has increased more than fourfold. The annual sales of electric current in 1909 totaled less than the monthly sales in 1929, and since 1905 gross earnings of this industry have increased over 900 per cent. Not only is the record of the public utility industry remarkable but its effect on domestic and industrial life is to a marked degree responsible for the increasing progress of this nation.

A number of investment houses have foreseen this remarkable development and have evidenced their vision by hitching their faith to the star of this essential industry. They have given substantial evidence of such faith by underwriting the securities of those companies which were ably managed and could reasonably, by expansion, show a sound earnings record. Their responsibilities in these undertakings were great, for not only were they staking their reputation and future on a young industry, but also diverting a large volume of their customers' funds to new channels.

As a result of a remarkable record of growth and prosperity, sound public utility securities have rewarded amply both the investment banker and the investor. Such was the care generally exercised by investment banking houses in underwriting securities of this class that capital loss in this field has been negligible in relation to the $26,500,000,000 now invested in the public utility business of this nation. In almost every instance the investor has been protected by a safe margin of earnings and assets.

Before the investor can purchase a public utility security sponsored by a reputable investment banking house considerable research is conducted by engineering, legal and accounting advisers, who view the proposed new offering from many angles. When the investor is finally asked to place his funds in a new security the safety of his investment in most cases has been assured.

Securities of power, light and gas companies have been in favor for investment funds for some time. Realizing the necessity of the services rendered and the field for future development, it can safely be said that carefully selected stocks and bonds of this industry will, over a period, yield large returns. Banks, life insurance companies and other institutions are among the largest American investors in public utility securities. Individual investors will do well to see that a substantial portion of their funds is concentrated in this field.

▼

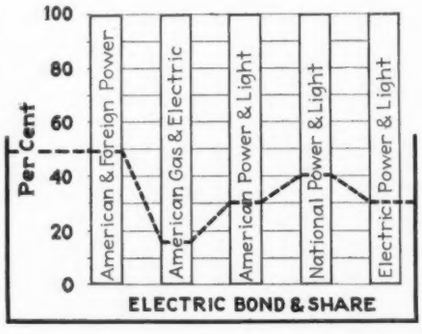
Interest Grows in Customer Ownership

INDICATIVE OF THE INCREASING TENDENCY to raise money for plant extensions and property development directly in the communities served, the National Electric Power Company, with extensive properties, particularly in the eastern part of the country, has laid out for its subsidiary operating companies for this year one of the largest customer-ownership programs it has ever had.

▼ ▼ ▼

Electric Bond & Share Investments Worth $1,278,444,806 in Market

AN ILLUMINATING picture of the growth of one of America's giant enterprises is shown in the annual report of the Electric Bond & Share Company, recently issued. Merger with Electric Investors, Inc., added investments of more than $200,000,000. Further securities of client holding companies were purchased and it is interesting to note that the company was in a position to come into the market with $47,000,000 after the break last fall.



Proportions of common stock of client companies owned by Electric Bond & Share Company

Book value of investments at the end of 1929 was $799,709,025 and market value $1,072,517,007. By the end of March this year book value had increased to $859,113,544 and market value to $1,278,444,806. Market value of net assets available for common stock at the end of 1929 was $81 per share and at March 31 this year $91.

Earnings on common stock for 1929 amounted to $1.97 a share on the stock outstanding at December 31 and $2.22 per share on a basis of the average amount of stock outstanding during the year. On the latter basis, for the year ended March 31, earnings were $2.31 per share.

The proportions of its client holding companies' common stock held by Electric Bond & Share Company at the end of 1929 were: American Foreign Power, 49.61 per cent; American Gas & Electric Company, 16 per cent; American Power & Light Company, 30 per cent; National Power & Light Company, 40 per cent, and Electric Power & Light Company, 30 per cent. As of March 31, 1930, on a book value basis, 87 per cent of the company's investments were in these five, 11 per cent in investments of miscellaneous companies and 2 per cent in wholly owned subsidiaries.

Surplus account as of March 31 showed a total of $689,735,802.

Manufacturing Continues at a Balance

AMERICAN manufacturing operations in the country as a whole continue to be maintained at a near-balance; in fact, during the first five months of the year the rate of operations has not varied by more than 2 per cent from the average for the period. Reports on electrical energy consumption for power purposes received by the ELECTRICAL WORLD from some 3,800 manufacturing plants scattered throughout the country indicate that while May operations were at a rate 1 per cent under April and 13.1 per cent under May last year, yet they were exactly at the same rate as recorded during May, 1928. The decrease from April to May was slightly greater than the normal seasonal decrease for this period. The average rate of activity for the first five months of the current year was 11.4 per cent under the same period in 1929, a year of record operations, but was approximately the same as that recorded for the same period in 1928.

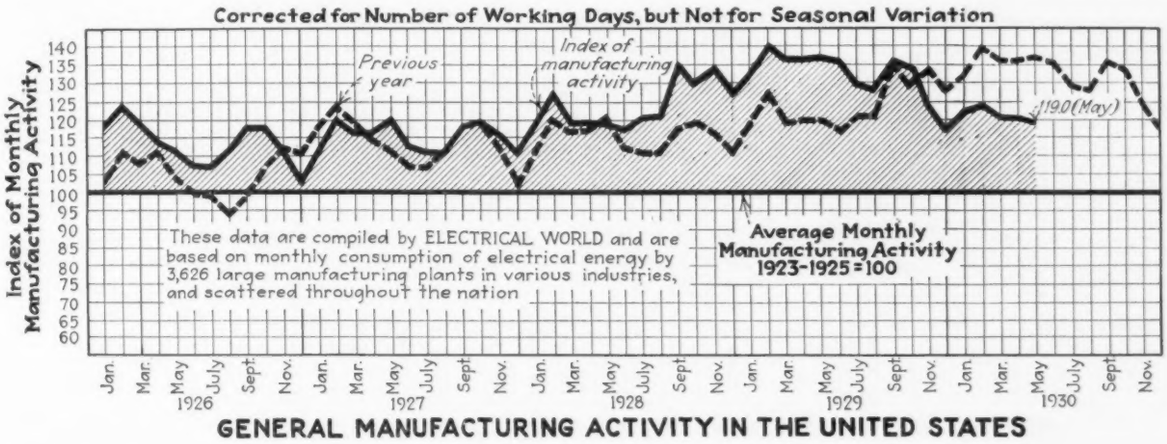
Three of the sections of the country—North Central, Southern and Western—reported increased operations during May as compared with April, the South leading with a gain of 4.1 per cent. All sections, however, reported manufacturing operations materially under those of last year.

Only three industrial groups witnessed increased operations during May over April, food products leading with a gain of 15.8 per cent.

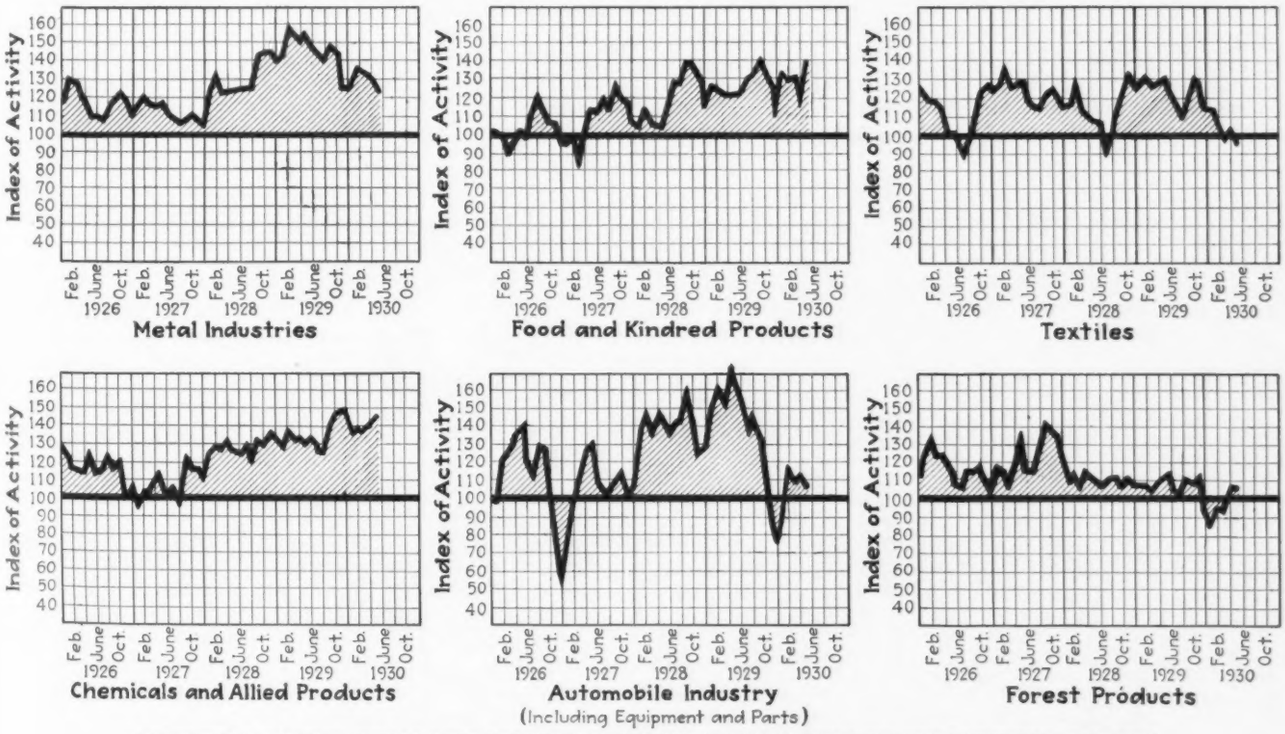
Current Manufacturing Compared with Other Periods

(Nation as a Whole)

Industrial Group	May, 1930, and April, 1930	May, 1930 and 1929	last 5 Months 1930 and 1929
All industry	— 1.0	—13.1	—11.4
Chemical products	+ 4.7	+13.5	+ 5.7
Food products	+15.8	+12.7	+ 4.4
Steel plants	— 2.3	—21.6	—13.2
Metal working	— 7.3	—19.3	—14.0
Leather products	—27.3	—30.4	—11.8
Timber products	— 0.4	— 7.8	—10.6
Paper and pulp	+ 4.4	+ 1.8	+ 0.9
Rubber products	— 2.3	—14.8	— 4.9
Shipbuilding	—13.0	—16.3	+10.2
Stone, clay and glass	— 6.1	—15.6	—14.4
Textiles	— 6.2	—26.1	—20.6
Automobiles	— 6.3	—34.6	—31.8


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
1190 (May)
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Distribution Survey Covers Electrical Wholesale Unit

UNSATISFACTORY credit conditions are one of the most serious problems of the wholesale electrical business today, Wroe Alderson of the Department of Commerce told the National Electrical Wholesalers' Association at Hot Springs, Va., during its recent convention. He summed up the results of a distribution survey of a representative electrical wholesaling establishment made over a three-year period by the Department of Commerce at the instance of the association.

This particular electrical wholesaler showed a decline in business in the past three years due to a combination of factors, many of which affect the industry as a whole. Operating costs showed a rapid rise when bad debt losses were included, but a slight decrease otherwise. Such factors as interest charges, distance of market from source of supply, etc., were shown to affect the profit figures.

An interesting and valuable part of the study has to do with bad debts, margin of profits, credit requirements, etc., in relation to type of customer. It is shown, for example, that bad debts fell into customer classes over the past three years thus, in percentage:

	Contractor Dealer	Contractor	Dealer	Unclassified
1927.....	1.94	1.75	0.00	0.97
1928.....	6.60	3.08	6.99	11.11
1929.....	11.68	21.95	5.39	66.33

Another group of studies were made by commodity divisions. These include sales and inventory, class of shipment, method of sales, etc.

The final table presented is one which affects all companies intimately—a study of gross and net profit by departments. It shows the gross profit for each commodity department and also the net profit that is obtained when operating cost is subtracted from gross profit. The commodity departments which were making a profit in 1927 according to these calculations were wire and cable, radio and accessories, safety switches, lamps, lighting equipment, electric fans and accessories, and pole line hardware. The largest profit accrued on lamps and pole line hardware and the greatest loss on the miscellaneous department, which included toys and games, flashlights, batteries and similar small electrical items.

▼

International Combustion Shows Heavy Deficit

A DEFICIT OF $4,454,517 is shown in the affairs of the International Combustion Engineering Corporation and its subsidiaries, according to a statement made public by Wilfred R. Wood, president of the corporation and co-receiver with the Irving Trust Company. The corporation went into receivership December 19, 1929.

During the period from January 1, 1929, until the receivership was effected the report shows that the corporation took a net loss from operations of $767,442. Losses incurred in the sale of capital assets and other special and non-operating losses totaled $2,028,845 during 1929. Total assets are placed at $57,981,548. The good will, patents, development expenses and similar assets were placed at $14,714,976.

The International Combustion Engineering Corporation is engaged in the development of companies that build automatic stokers, equipment for preparing and burning fuel and similar products.

▼

Westinghouse Agreement With English Electric

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces that through its subsidiary, the Westinghouse Electric International Company, it has entered into a comprehensive arrangement with the English Electric Company, Ltd., of Queens House, Kingsway, London, whereby there will be an exchange of technical information between the two organizations on steam turbines and electrical apparatus.

The arrangement includes the granting of licenses for the use of patents and for the manufacture and sale of various products. These licenses will, of course, be subject to the existing commitments of the two companies in various parts of the world. Under this arrangement each company will have the benefit of the results of the research work carried on by each in the fields covered by the agreement.

The technical and manufacturing link thus established does not entail any control of the English Electric Company, Ltd., by American interests. The British interests in control of the English Electric Company, Ltd., believing that a moderate financial interest on the part of the Westinghouse companies would be desirable, have suggested a participation in the ordinary shares of the company, but this participation will in any event be under 10 per cent of the total, and if accepted by the Westinghouse companies will increase the new money by such an amount as may be finally determined upon.

▼

Square D Company Merger Is Completed

MERGER OF THE Square D Company of Detroit and the Diamond Electrical Manufacturing Company of Los Angeles has been completed. Hereafter the Diamond Electrical Manufacturing Company will operate as a subsidiary of the Square D Company. According to information given out, the entire sales structure of the Square D Company in the West is being merged with that of the Diamond Electrical and all sales of Square D products in the West will be handled by the Diamond Electrical organization. On the other hand, all Eastern sales of Diamond Electrical products will be handled through the offices of the Square D Company.

With the completion of the merger distributing offices will now be maintained for the products of the two original companies in all principal cities and manufacturing plants are located in Detroit, Los Angeles, San Francisco, Peru, Ind.; Houston, Tex.; Milwaukee, Wis., and Walkerville, Ont. Products of the combined companies include almost every type of control equipment, including automatic starters, manual compensators, automatic compensators, pressure, float and limit switches, motor

circuit breakers, safety switches, automatic motor control, remote control switches, relays, automatic heat controls, etc.

▼

Claude Neon Subsidiary

CLAUDE ILLUMINATION COMPANY has been incorporated by Claude Neon Light to manufacture and market illuminating devices which have been perfected in the low-voltage field of tube lighting. The new company is a Delaware corporation with capitalization of 100,000 shares of common stock, nominal par value of $1. There will be no public offering.

The president of the new corporation will be Leroy P. Sawyer, formerly with General Electric "Mazda" lamp interests.

▼

Rural Electrification Expands

NEARLY 100,000 FARM CUSTOMERS were added to electric power lines during 1929, according to a recent estimate of the statistical research department of the National Electric Light Association. The number of farms served at the end of 1929 is given as 557,700, an increase of 97,733, or about 21 per cent, over the 459,967 at the end of 1928. Since the total number of farms in the United States is given as 6,371,640, it is seen that only 8.8 per cent are now served.

The states in which the largest numerical growth occurred during the year are California, 9,970; Michigan, 7,648; Wisconsin, 7,477; Ohio, 7,470.

Allis-Chalmers Reports Record Unfilled Orders

UNFILLED ORDERS reported by Allis-Chalmers Manufacturing Company at the end of May totaled $17,342,000, a gain for the fifth consecutive month.

Although new bookings of $4,708,000 in May were somewhat less than those of March and April, they exceeded those of the same month of 1929. For the first five months they totaled $24,871,000.

▼

TRADE BRIEFS

Sales of the United Conveyor Corporation of Chicago for this year to date are 20 per cent greater than for the corresponding period of 1929. This gives the company the largest volume in its history.

•

Crocker-Wheeler Electric Manufacturing Company has added to its directorate M. Hartley Dodge and Herbert C. Petty.

•

Steel & Tubes, Inc., announces the removal of the general sales department of the electrical division from Brooklyn, N. Y., to its general offices in Cleveland, Ohio.

•

Weston Electrical Instrument Corporation for quarter ended March 31, 1930, reports net income of $255,162 after depreciation, federal taxes, etc., equivalent under the participating provisions of the shares to $1.48 a share on 50,000 no-par shares of class A stock and $1.23 a share on 146,600 shares of no-par common stock. This compares with $229,678, or $1.19 a share, on 75,000 class A and 94 cents a share on 150,000 common shares in first quarter of 1929.

•

It is announced by the Burke Controller Corporation and the management of Ward Leonard Electric Company that the entire physical assets of Burke Controller Corporation have been purchased by Ward Leonard. The present factory of Burke Controller will be moved to the Ward Leonard plant at Mount Vernon, N. Y.

•

American Transformer Company announces that E. P. Larkin has joined the staff to direct the expansion program which the company has under way. Mr. Larkin has specialized in welding application work.

▼

Copper Recedes Slightly

PRICES ON COPPER AND ZINC have given way slightly from the levels maintained in recent weeks, copper now being available at 12¾ cents, delivered Connecticut, and zinc at 4.55 cents. Neither price is general, but has been brought about by individual sellers cutting prices in an effort to get rid of stocks which were larger than they were willing to hold.

	June 4, 1930 Cents per Pound	June 11, 1930 Cents per Pound
Copper, electrolytic	13	12.75
Lead, Am. S. & R. price	5.50	5.50
Antimony	7¼	7¼
Nickel, ingot	35	35
Zinc, spots	5.00	4.55
Tin, straits	30¼	29⅛
Aluminum, 99 per cent.	24.30	24.30

▼

Pole Tariff Question Is Settled

THE PROPOSED TARIFF ON POLES for electric, telephone, telegraph and trolley purposes has been eliminated by the conference committee and no longer stands to increase the costs of rural electrification. Softwood lumber and poles, duty free under existing law, were placed at $1.50 per 1,000 ft. board measure in the Senate bill. Poles now return to the free list and softwood lumber tentatively has been set at $1 per 1,000 ft. All cement is taken from the free list and made dutiable at 6 cents per 100 lb. The Blease amendment to retain imports of cement for state and municipal purposes was stricken out in committee. These changes finish the commodity schedules in the forthcoming tariff.

The pole duty is said to have been inserted under the advocacy of Senator Johnson of California.

▼ ▼ ▼

DELINQUENT ELECTRICAL ACCOUNTS

(National Electrical Credit Association)

Number of Accounts Reported

Division	May 1929	May 1930	Per Cent Increase or Decrease	Five Months 1929	Five Months 1930	Per Cent Increase or Decrease
New York	287	322	+12.2	1,255	1,644	+31.0
Middle and Southern Atlantic	189	128	—32.3	780	929	+19.1
New England	161	138	—14.2	826	704	—14.7
Central	648	861	+32.9	3,219	4,142	+25.6
Total	1,285	1,449	+12.8	6,080	7,419	+22.0

Total Amounts Reported

Division	May 1929	May 1930	Per Cent Increase or Decrease	Five Months 1929	Five Months 1930	Per Cent Increase or Decrease
New York	$55,759	$47,812	—14.3	$253,939	$285,352	+12.3
Middle and Southern Atlantic	34,815	31,303	—10.6	116,333	149,717	+28.7
New England	24,978	22,929	— 8.2	109,482	110,266	+0.71
Central	73,515	212,957	+53.7	401,752	582,725	+45.0
Total	$189,067	$215,001	+13.7	$881,510	$1,128,060	+27.9

Market Conditions

LARGER equipment orders have declined slightly in the Eastern district. Railway and marine business is active. Meter and transformer business has declined noticeably in the Pacific Coast area, but day-to-day business is well maintained.

——CENTRAL-STATION ORDERS ARE LIMITED in the New England district, but specialties, including marine equipment, are in substantial volume.

▼ ▼ ▼

EASTERN

—DEMAND FOR ELECTRICAL EQUIPMENT *in the Eastern district shows little change, with the possible exception of increased smaller commitments for industrial as well as public utility account. Meantime, larger orders show signs of slight recession, although inquiries indicate that further buying of sizable extent is on the way.*

—STEEL MILLS OFFER *promising immediate business and the month is expected to show good volume sales in that line. Both railway and marine business continue active.*

Central-station business is holding up well. A northern New York power company has contracted with a state maker for switchgear, transformers and auxiliary equipment to an amount of $230,000. A Long Island central station has closed with a New York manufacturer for substation apparatus to cost $45,000. A Connecticut power utility has purchased switchgear and accessories to the sum of $35,000. A metropolitan central station has contracted for motors, controls, etc., with a state maker, costing $100,000, and has also placed a commitment for switchgear to an amount of $40,000 with the same manufacturer.

Impending sizable demand for iron and steel account is indicated by expansion projects now maturing. The Midwest Steel Corporation, an interest of the National Steel Corporation, Wierton, W. Va., has plans for a new mill on 1,000-acre tract of land at Gary, Ind., to cost over $25,000,000. The Illinois Steel Company, South Chicago, Ill., will build additions to cost $1,000,000. The Otis Steel Company, Cleveland, Ohio, will carry out an expansion program to cost more than $500,000, including installation of equipment for electric steel casting production. A steel company in northern New York has placed a contract with a state manufacturer for motors and control apparatus to cost $30,000.

A manufacturer of wire and cable says that a careful survey of the present situation shows improvement in central station and street-lighting operations, with corresponding increase in demand. Building work, it is stated, holds little, if any, promise for the remainder of the year, both with regard to residential and industrial construction. A manufacturer of industrial motors says that orders are scattered and that incoming account is considerably lower than during the early months of the year; current account is on a very limited basis. A producer of control apparatus reports an improved volume of inquiries during the past few weeks, but a lower quota of actual orders; buyers are hesitating, and contracts which should have been closed last month are still pending.

The General Electric Company has received a contract for the electrical installation for a government lighthouse tender to be constructed at Jacksonville, Fla., consisting of two 100-kw. generator units and complete accessories. A manufacturer of air compressors in Pennsylvania is operating on a full capacity schedule and reports orders for the past month totaling $500,000.

CONSTRUCTION PROJECTS

The Signal Supply Officer, Signal Section, New York General Depot, Brooklyn, will receive bids until June 17 for generators in lots of 50 to 500 (Circular 157). The American Potash & Chemical Company, New York, has plans maturing for extensions and improvements in plant at Trona, Calif., to cost $4,500,000. United States Potash Company, operated by Snowden McSweeney Company, New York, plans mining and refining plant at Hobbs, N. M., to cost about $1,000,000. Huasteca Petroleum Company, New York, contemplates plant at Tampico, Mexico, to cost over $5,000,000. War Department, Washington, D. C., plans power house and other buildings at Picatinny Arsenal, Dover, N. J., to cost $450,000. Perth Amboy, N. J., plans ornamental lighting system. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until June 17 for one electric furnace for the Philadelphia navy yard (Schedule 3563). General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until June 27 for insulated cable, wire, panelboard, plugs, etc. (Panama Schedule No. 2567). Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids for complete fire alarm system at ammunition depot, Hawthorne, Nev. (Specification 6162).

NEW ENGLAND

—ORDERS FOR ELECTRICAL EQUIPMENT *during the past week were confined mainly to small motors, switch and control equipment and numerous special apparatus. Small motor orders held up well and are maintaining a gain over last year. General scheduled equipment sales are steady. Meter sales and small generator units are attracting interest. Central-station supplies are spotty.*

Recently crossarm orders for one company amounted to over $50,000 for delivery on new transmission lines. Cable and line hardware sales are active. Among various specialties actively in demand are noted a rapid growth in marine electrical equipment, intercommunication installations and floodlighting equipment for recreational purposes. One manufacturer notes a number of interesting orders for electrical equipment for large motor pleasure yachts. Activity in shipyards in Quincy, Mass., is reflecting numerous orders for electrical equipment. Street-lighting equipment is selling well, and appropriations for traffic signals, the latter electrically controlled, have been recently passed and orders are expected soon for installations in a number of municipalities.

CONSTRUCTION PROJECTS

New England Telephone & Telegraph Company, Boston, Mass., plans equipment storage and distributing plant at Watertown, Mass., to cost over $400,000. Springfield, Mass., has plans for a municipal repair shop to cost $100,000. State Board of Education, Hartford, Conn., will take bids on revised plans for trade school at Meriden, Conn., to cost $150,000.

❖

MIDDLE WEST

—GENERAL BUSINESS IN THE *Middle West section continues to mark time. Some slight increase in the volume of business transacted is noticeable, but general conditions remain spotty.*

—MAJOR ACTIVITIES, *steel, railroad, automotive and electrical industries, are maintaining their position. Some slight acceleration in building construction is noted and carloadings increased somewhat. Retail trade is not up to expectations, but it is felt that some improvement will be made this month.*

Some of the interesting orders placed this week include 15,000 210-kva. suspension type porcelain insulators, six 600-amp., 15-kv., single-pole, single-throw, wheel-mounted oil circuit breakers, four 667-kva., 12,000-volt, single-phase, oil-insulated, water-cooled transformers, three 883-kva., 12,000-volt,

single-phase, oil-insulated, water-cooled transformers, "Mazda" lamps valued at $125,000, and several construction orders aggregating $150,000.

More railroad and municipal business is being obtained, with a slight betterment in industrial business. There has been a good demand for small appliances, with a particularly good demand noted for washing machines and electric refrigerators, one jobber placing a single order for 500 washing machines and 500 electric refrigerators this week.

CONSTRUCTION PROJECTS

Columbus, Wis., plans extensions and improvements in municipal electric power plant. Consumers Power Company, Jackson, Mich., plans extensions in plant and system at Addison, Mich. American Steel & Wire Company, Chicago, Ill., will build addition to plant at DeKalb, Ill., to cost $300,000. East Chicago, Ind., plans municipal electric light and power plant, reported to cost over $100,000. Caterpillar Tractor Company, Peoria, Ill., plans factory branch at Minneapolis, Minn., to cost $200,000. Valentine, Neb., contemplates ornamental lighting system. Chicago, Rock Island & Pacific Railroad, Chicago, Ill., will build engine house and shops at Des Moines, Iowa, to cost $100,000.

❖

SOUTHEAST

—THE VOLUME OF BUSINESS *reported in the Southeast continues at about the same level as for the previous week.*

An Alabama Company placed orders for approximately $50,000 worth of motors and control equipment. Two carloads of wire were reported moving into the territory; one into Georgia and one into Florida. A South Carolina company placed an order for transformers, lightning arresters and switching material amounting to approximately $10,000. A Louisiana company placed an order for street-lighting equipment amounting to approximately $10,000. A South Carolina concern placed an order for small transformers amounting to approximately $3,000.

Some other orders originating in Georgia were as follows: Regulators amounting to approximately $22,000, disconnect switches amounting to approximately $18,000, and pole line hardware amounting to approximately $5,000. One Georgia company's distribution and small power transformer orders for the past week aggregated $2,700 and its meter purchase aggregated $3,800. Some other central-station orders were for crossarms amounting to $1,000, poles amounting to $1,000 and wire amounting to $2,000.

CONSTRUCTION PROJECTS

Chesapeake & Ohio Railroad Company, Richmond, Va., approved plans for coaling pier at Newport News, Va., to cost $1,500,000. Owensboro, Ky., plans extensions and improvements in municipal electric light and power plant. Mountain Power Company, Chattanooga, Tenn., contemplates hydro-electric power plant on Tellico River, to cost $500,000. Greenville, S. C., plans installation of airport lighting system. Hazlehurst, Miss., plans municipal electric light and power plant. Florida Power Company, St. Petersburg, Fla., plans extensions in transmission lines in Wakulla County.

❖

PACIFIC COAST

—ORDERS FOR RAILROAD EQUIPMENT *and large motor orders have given rise to substantial business this week, although several orders have been held up. Orders for meters and transformers have decreased notably.*

Railroad business covers such actual orders as fifteen General Electric electric car equipments valued at $80,000 for southern California. Prospective orders, such as a $150,000 Southern Pacific lamp contract and a quarter year's requirements of wiring supplies and line material, are reported, but actual ordering has been curtailed, many outstanding orders have been temporarily canceled and considerable personal cuts have been made because of decreased freight and passenger receipts. Buying for the state is brisk in widely scattered small shipments. Industrial buying covers $2,000 worth of motors and controls for pumps, $20,000 worth of General Electric crane motors and controls and a 625-kva. waterwheel generator valued at $8,000 for a sugar plantation.

Power company buying is fair, with such outstanding orders as a $40,000 Westinghouse switchboard and nine General Electric 72-kva. induction motor regulators valued at $15,000 for central California territory, but such staples as motors, meters and distributing transformers have markedly decreased. Floodlights and spotlights totaling 750 kw. have been installed in the San Francisco Civic Center for the forthcoming N.E.L.A. convention. Schools continue to be the major construction item, including a $650,000 junior high school for San Francisco, $400,000 schools for San Jose, Oakland, Santa Ana, $350,000 schools for the deaf in Berkeley and Pittsburg, a $750,000 teachers' college in San Jose and an $800,000 state prison and reformatory group.

Board of contracts and awards, Tacoma, is taking bids until June 23 for furnishing $20,000 worth of motors for operating stokers, circulating water heaters, etc., in steam auxiliary plant No. 2, machines ranging from 500 hp. down, also for switchboards and instrument transformers. Specifications for the projected $450,000 steam emergency power plant to be built in Eugene, Ore., are being completed by the Eugene water board and bids for plant and machinery will be called shortly. Sales reported last week included one 69,000-kv. outdoor type motor-operated oil circuit breaker and miscellaneous disconnecting switching equipment to Puget Sound Power & Light Company for installation in Nineteenth Street substation in Tacoma, 75 distribution transformers ranging from 37½ kva. down to Seattle central stations, ten motors from 100 hp. down to sawmills and allied industrials, four motors of 100 hp. each to a department store, two motors of 100 hp. each for hotel for elevators and 40 machines from 50 hp. down to dealers in eastern and southwestern Washington.

CONSTRUCTION PROJECTS

Los Angeles Water and Power Bureau, Los Angeles, Calif., has plans for power substation to cost over $100,000. Los Angeles, Ventura, Porterville, Glendale and Livermore, Calif., plan ornamental lighting systems. William Shredded Wheat Company, San Francisco, Calif., plans factory to cost $115,000. Puget Sound Power & Light Company, Seattle, Wash., plans power substation. Montana States Power Company, Tacoma, Wash., plans extensions and improvements in power plant, substations and transmission lines at Kalispell, Mont., and vicinity to cost $230,000. Great Northern Railway Company, St. Paul, Minn., plans power plant at Whitefish, Mont., to cost $50,000. Veterans' Bureau, Washington, D. C., will receive bids until June 17 for a refrigerating plant for institution at Fort Bayard, N. M.

❖

SOUTHWEST

—THE TENDENCY FOR THE PAST WEEK *among utilities and industrials has been careful buying. No one seems to be making estimates for future requirements and buying is only for urgent necessities.*

An anticipated large order for generators and transformers for a Missouri water power development has not yet been officially closed. Other good-sized orders are being held up for various reasons. The only contracts reported worthy of mention were for a three-phase, 1,500-kva. transformer for $10,000 and a lot of 15-hp. motors for oil well pumping for $4,500.

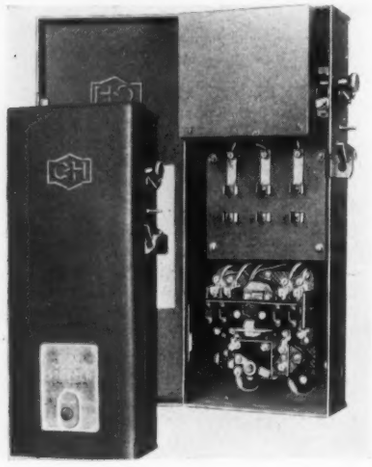
CONSTRUCTION PROJECTS

California, Mo., will soon take bids for municipal power plant to cost $50,000. Warson Petroleum Company, St. Louis, Mo., plans plant to cost $200,000. Union Electric Light & Power Company, St. Louis, Mo., plans extensions in transmission lines and substations to cost $5,000,000. Arkansas Power & Light Company, Little Rock, Ark., plans addition to substation at Searcy, Ark., to cost $50,000. Central Power & Light Company, San Antonio, Tex., will install ornamental lighting system at Del Rio, Tex.

New Equipment Available

Automatic Starter With Fusible Disconnect

THE DEVELOPMENT OF A NEW a.c. across-the-line automatic starter combined with a fusible disconnect switch in a single steel-inclosing case is announced by Cutler-Hammer, Inc., Milwaukee, Wis. This starter may be used



in place of the separate starter and fusible disconnect, requiring less space, simplifying installation and presenting a neater appearance. A feature is a wiring channel between the starter panel and the back of the inclosing case, which allows running the connecting wires behind the panel, where they cannot interfere with the operation of the starter.

The disconnect switch is manually operated from the outside of the inclosing case. A cover interlock prevents opening the cover when the switch is closed and prevents closing the switch if the cover is open, unless the interlock is manually released. An electrical interlock insures that the magnetic contactor of the starter is always open when the disconnect switch is open.

▼

Light-Duty Motor Disconnect Mechanism

A NEW TYPE MOTOR MECHANISM for use with outdoor disconnecting switches is announced by the General Electric Company. This mechanism is a light-duty type for pole or bracket mounting and is suitable for application to outdoor group disconnecting switches, 44 kv. and below. The device consists of a ½-hp. motor direct connected to an inclosed reduction gear, with a cam type spring-pressure brake. The main driving shaft from the gear box extends through the rear of the housing, and to this is attached the switch-operating crank, which rotates 180 deg. in both the opening and closing strokes.

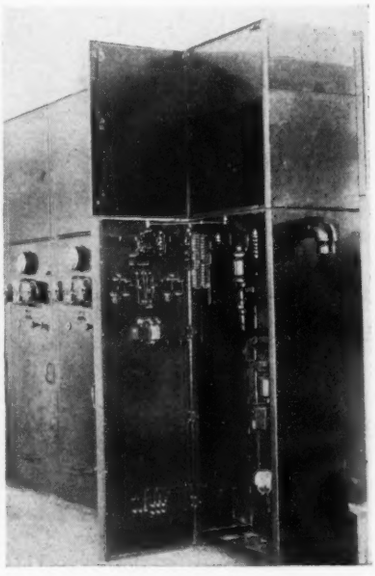
The operating pipe moves in either an up or down direction, when closing or opening the switch, respectively, making it particularly adapted to the General Electric type TA tilting-insulator switch. For application to rotating insulator switches an indirect type of operating mechanism is used; the transfer of motion from the vertical to the horizontal is obtained by replacing the outboard bearing with a bell crank.

▼

Indoor Cubicle Switching Equipment

A NEW LINE OF INDOOR cubicle type switching equipment is announced by the Westinghouse Electric & Manufacturing Company. The cubicles, consisting of oil breakers and vertical swinging panes, with disconnecting switch compartments, may be used for the control of feeders, transformers or generators, or for any other application calling for oil breakers and a switchboard.

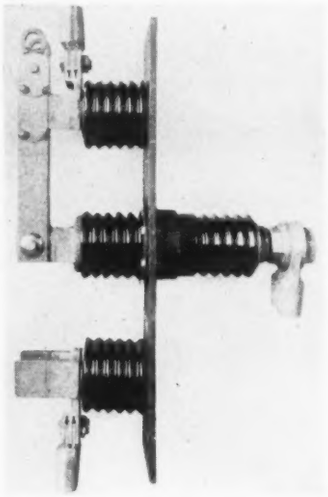
These cubicles are designed to give the advantage of complete factory-assembled, steel-inclosed, safety type



switching equipment at a minimum expense. These units are for manually, a.c. motor or d.c. solenoid-operated oil circuit breakers and may be equipped with automatic reclosing equipment.

Connected Selector or Transfer Switch

AN IMPROVED TYPE OF COMBINATION front and back connected selector or transfer switch for voltages up to 25 kv. is announced by the Champion



Switch Company, Kenova, W. Va. This switch is of the double blade type with safety locks and terminals for use with either flat or round conductors.

▼

Welding Electrode for Light-Gage Material

A NEW WELDING ELECTRODE for use on light-gage material, which will be known as "Lightweld," has been announced by the Lincoln Electric Company, Cleveland, Ohio. It can be used on 16, 18, 20 or 22-gage in making a lap, butt or corner weld. It gives a dense weld, free from pin holes. It was designed to be used with a manual carbon arc and with from 30 to 60 amp. direct current and is suitable for horizontal, vertical or overhead work. The size of the rod is ⅛ in. in diameter and 30 in. long and is put up in 10-lb. containers.

The carbon used with it should be ⅜ in. in diameter and should be tapered gradually from a sharp point back about 1½ in. and should be gripped in the holder about 2 in. from the point. A 100-amp. machine is desirable for this rod, although not necessary; 200-amp. machines can be used, and even 300 amp. provided stable conditions are obtained at the low currents required for the proper procedure on "Lightweld." Speeds of from 7 to 18 in. per minute can be obtained, depending upon the type of joint (lap, corner or butt), gage of the material, the setup or tightness of the joint before welding and the skill of the operator.